FINAL REPORT

PALOMAR TROLLEY CENTER TRAFFIC IMPACT ANALYSIS

JHK & Associates

Prepared For

CITY OF CHULA VISTA

Cotton/Beland & Associates

April 1991

PALOMAR TROLLEY CENTER
TRAFFIC IMPACT ANALYSIS

Prepared for:

The City of Chula Vista

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JHK & Associates

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1. INTRODUCTION

The purpose of this study is to analyze existing and future traffic and circulation conditions adjacent to the proposed Palomar Trolley Center development project. This introduction describes the proposed development and outlines the contents of this traffic analysis report.

BACKGROUND

Pacific Scene, Inc. is proposing construction of a 198,200 square foot community shopping center on an 18.2 acre site with parking space for 991 vehicles. The project site is located in the City of Chula Vista along the south curbline of Palomar Street between the Palomar Street Trolley Station and Broadway. A portion of this site (12.23 acres) had previous traffic studies prepared for a smaller community shopping center proposed by Pacific Scene, Inc. Reference to these earlier plans and studies is provided below.

This report begins with an analysis and description of existing conditions in the project vicinity. Land use and trip generation for the proposed project is then presented, followed by a description of the trip distribution procedures to load project trips onto the street system. Where potential adverse traffic related impacts are identified, measures to mitigate them are suggested.

The first task of this impact analysis was to review traffic reports prepared for the original Palomar Trolley Center project prepared by Willdan Associates (Traffic Analysis for Palomar Trolley Center, October 14, 1988) and JHK & Associates (JHK & Associates Review of the Palomar Trolley Center Traffic Analysis by Willdan Associates, January 15, 1989). These reports served as a basis for this analysis. The land use plan and the intensity of development has been changed by the developer, Pacific Scene, Inc. since the Willdan report was prepared, but the same trip generation rates were used for this proposed project.

This study included the impacts of all proposed development on the Trolley Center site. In addition to the proposed project, two alternatives with reduced land use intensity were analyzed in this study, including a no-build alternative, and an alternative that represents a ten percent reduction in land use intensity from the developer's proposed project.

The original scope of work was expanded to include an analysis of the study area intersections using the "Operational Analysis" method from the 1985 Highway Capacity Manual (HCM). JHK was also asked to perform an arterial signal timing analysis to investigate the feasibility of traffic signal modifications including the addition or relocation of traffic signals along the project site frontage.

SCOPE

This report begins with a description of the existing setting and analysis of existing traffic conditions. Future Year 1991 conditions are then analyzed without the project to be used as a base for determining project impacts. Land use and trip generation for the proposed project is then presented, followed by a description of the trip distribution procedures. Project impacts are then discussed with a technical analysis of critical intersections (using the Intersection Capacity Utilization [ICU] method). The next chapter evaluates the planned parking, access, and internal circulation for the project, and the report concludes with a summary of recommendations for mitigation measures to address the future impacts of this proposed Palomar Trolley Center project. These mitigation measures are based on the standard analysis of future intersection needs using the ICU method along with the findings of the detailed HCM analysis (see Chapter 9) at the critical intersections which are impacted by the future trolley operations and associated with delays resulting from the accumulation of gate-down time.

2. EXISTING CONDITIONS

The Palomar Trolley Center development project site is located in the southwestern portion of the City of Chula Vista, illustrated in Figure 2-1, is located south of Palomar Street, between Industrial Boulevard and Broadway. The project site is approximately 18.2 acres in size. As shown on Figure 2-2, Palomar Trolley Center Site Plan, the project proposes four points of access from Palomar Street, and one access point from Broadway. The project proposes to retain the existing trolley station signal and to add an additional midblock signal at the project main entrance. The project site is currently vacant and surrounding land uses consist of commercial and light industrial land uses. Regional access to the site is provided by Interstate Route 5 via its diamond interchange with Palomar Street.

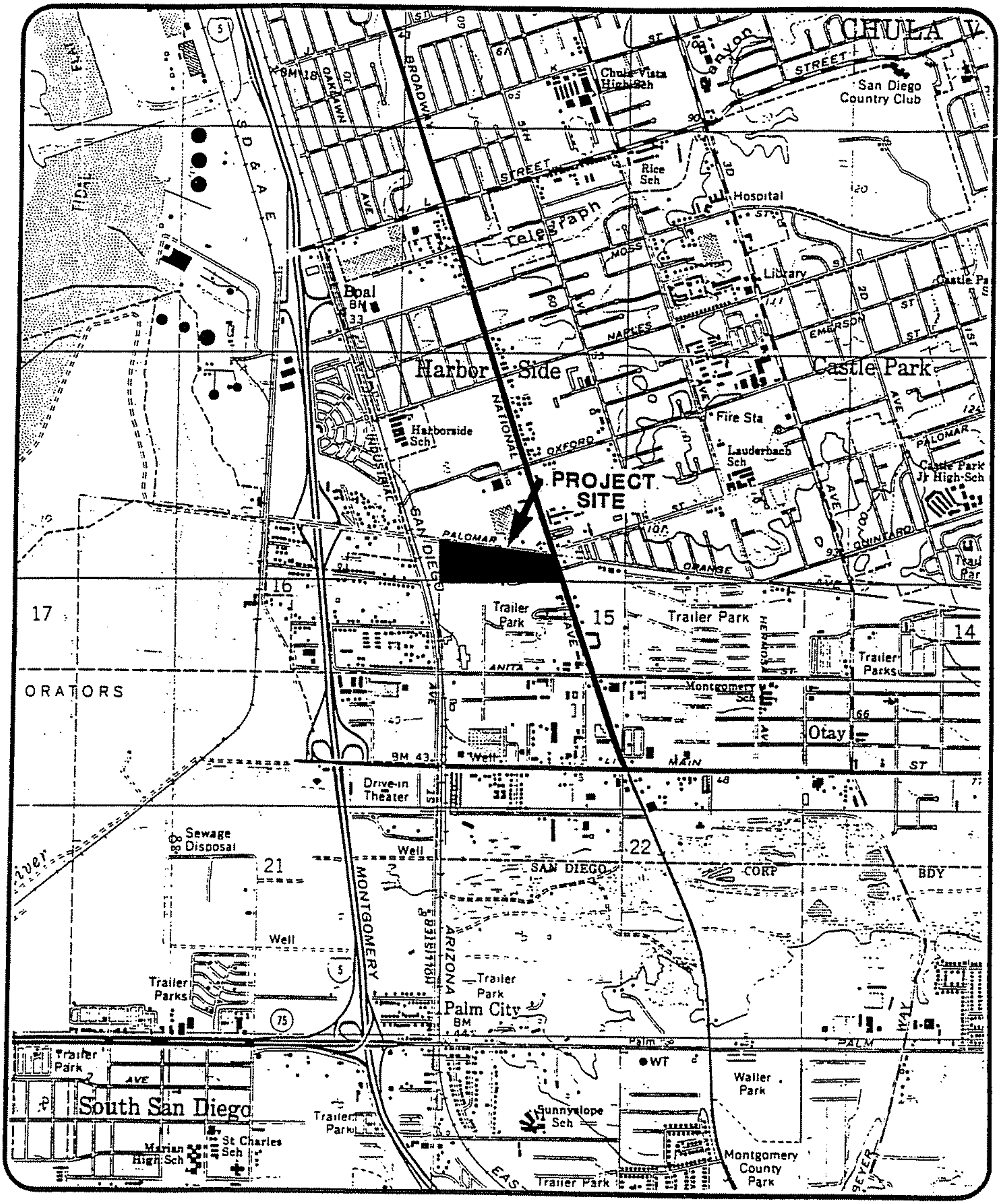
PROJECT SETTING

The study area for the project, shown in Figure 2-3, along with the existing circulation network is within the boundaries of Palomar Street, Interstate Route 5, Main Street, and Broadway. Study area intersections include the intersections of Palomar Street with Interstate Route 5, Industrial Boulevard, Palomar Trolley Entrance, Broadway and Orange Avenue, Anita Street with Industrial Boulevard and Broadway, and Main Street with Broadway.

Figure 2-4 shows the average daily traffic (ADT) volumes with existing network street classifications in the study area. The volumes shown were derived from the City of Chula Vista Traffic Flow Report dated November 12, 1990. Most of the traffic generated by the project from outside Chula Vista will access the site via the Interstate Route 5/Palomar Street interchange. Broadway and Palomar Street will provide the primary access to the site for trips originating in Chula Vista.

Interstate Route 5 is an eight-lane freeway in the vicinity of the Palomar Trolley Center project site. It extends southward to the California-Mexico border and to the north through downtown San Diego providing interstate travel through California, Oregon, and Washington. The current ADT volume on Interstate Route 5 is 141,000 vehicles per day (vpd) north of Palomar Street and 143,000 vpd south of Palomar Street.

Palomar Street presently functions as a four-lane major street with an east/west orientation. It extends from Bay Boulevard to the west and east to Oleander Avenue. Palomar Street has an

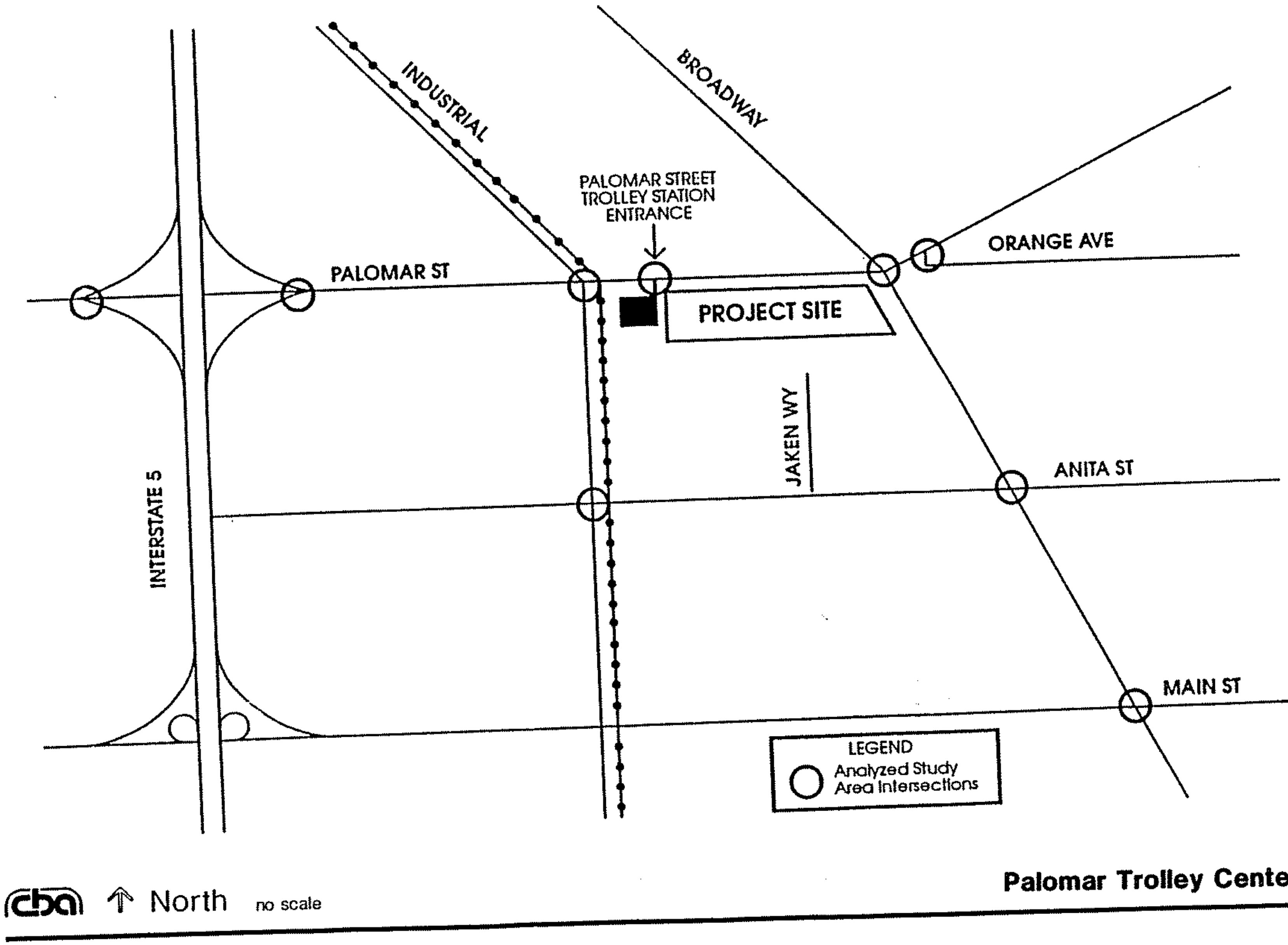


Scale
1" = 2000'

Figure 2-1

Source: USGS Quadrangle Imperial Beach

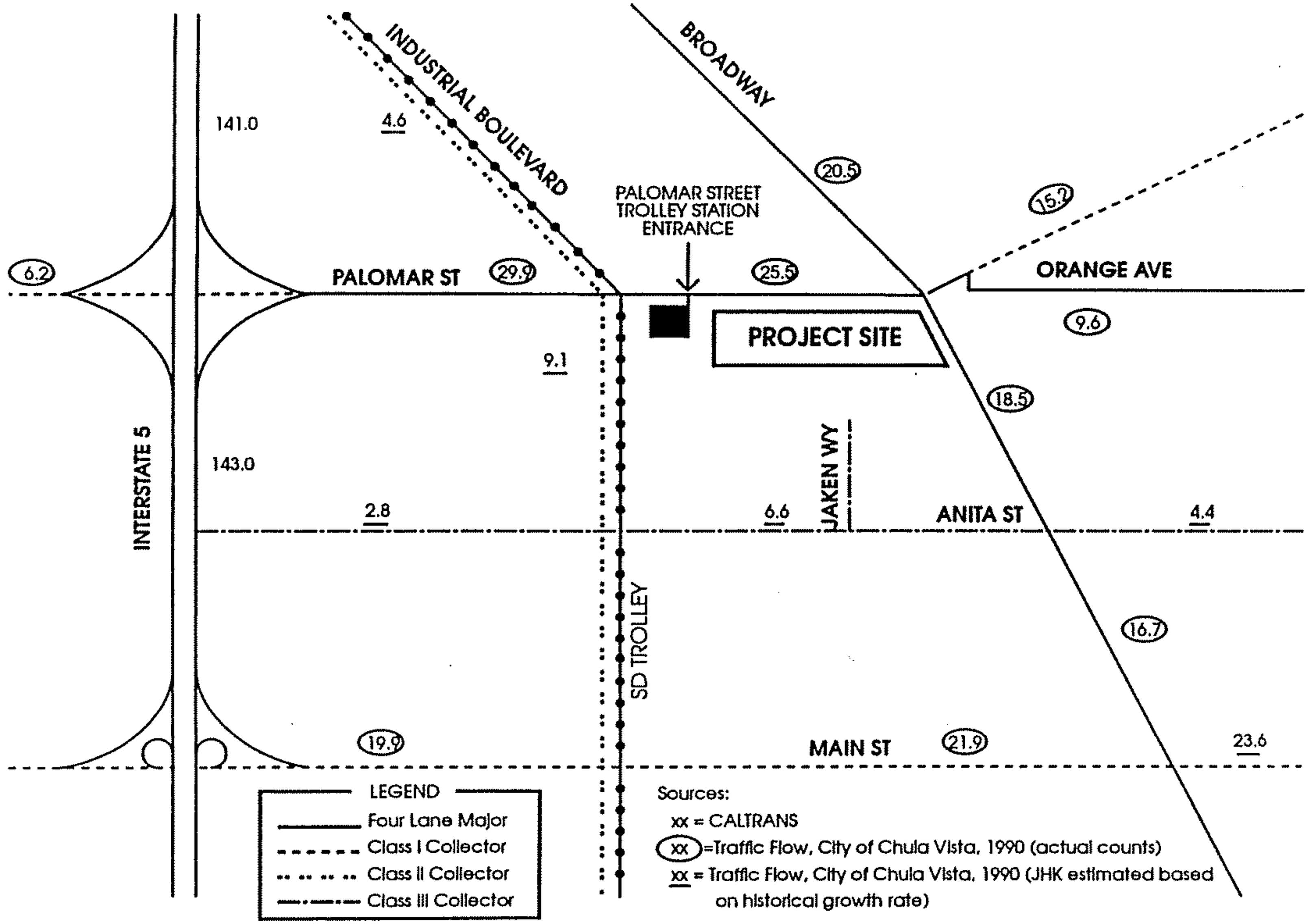
VICINITY MAP



Palomar Trolley Center EIR

SOURCE: JHK & Associates

Figure 5-11
Study Area



↑ North no scale

Palomar Trolley Center EIR

SOURCE: JHK & Associates

Figure 5-12

Existing Street Network and Traffic Volumes

(in thousands) Year 1990

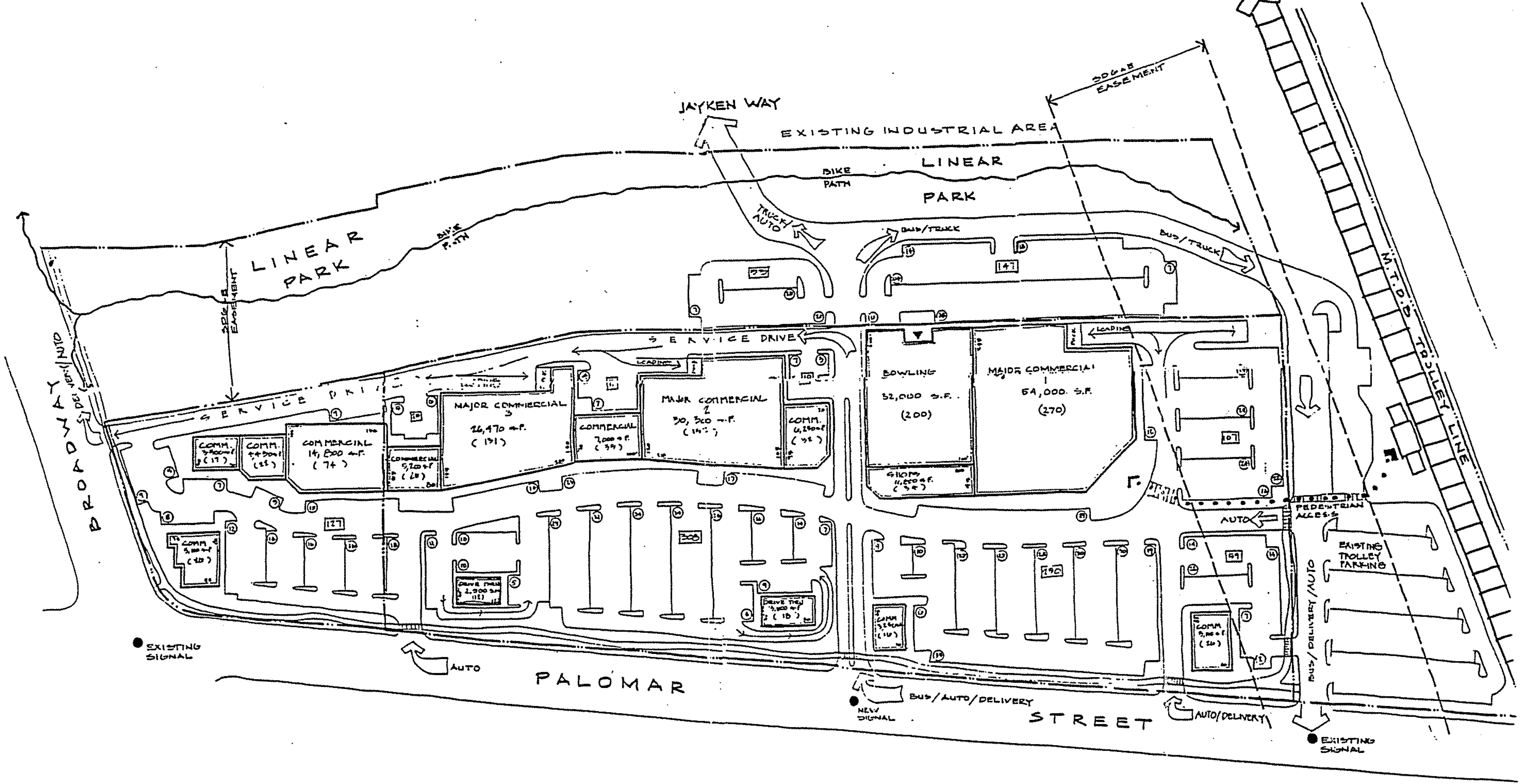


Figure 2-2

SITE PLAN

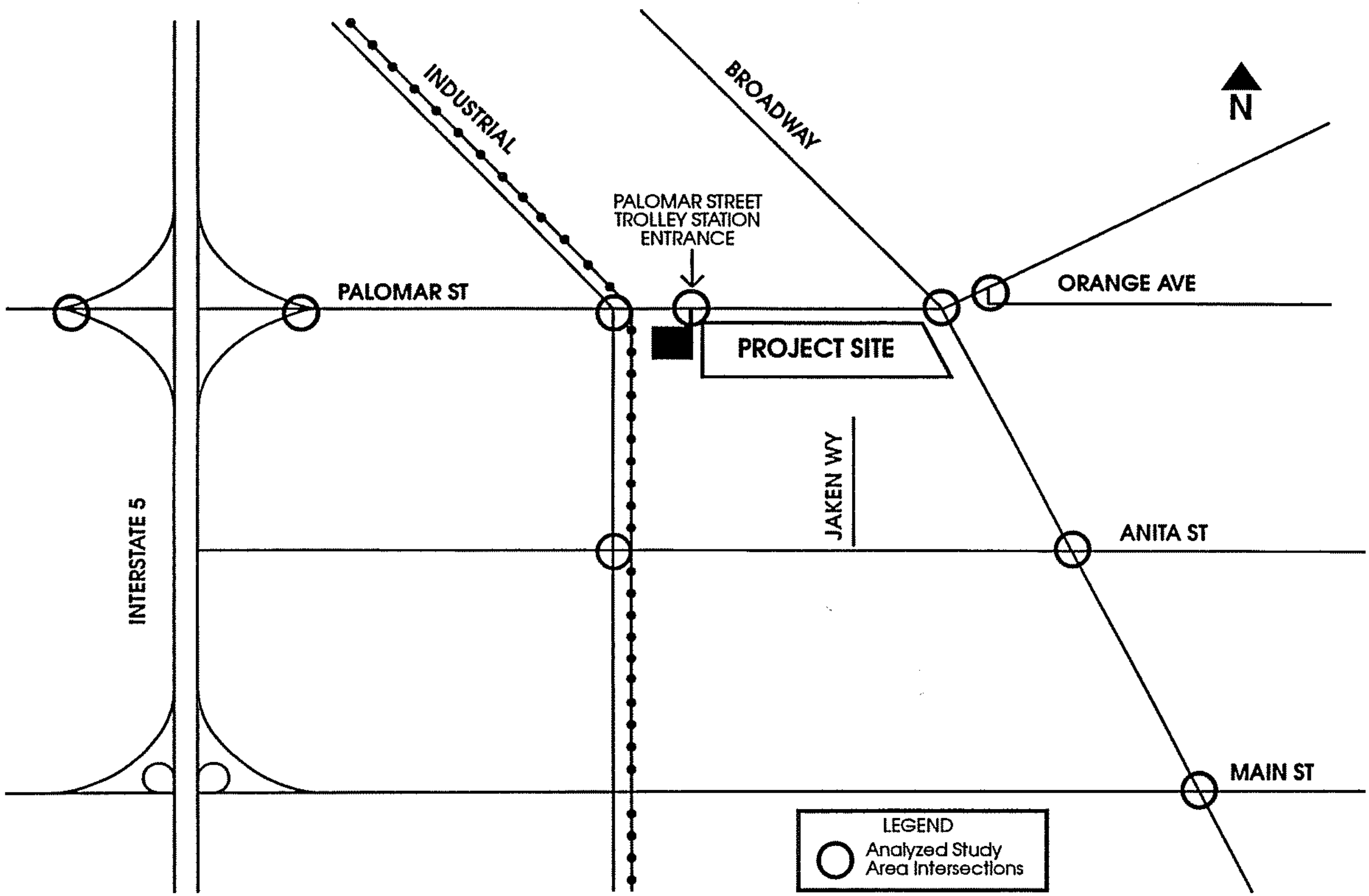


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Figure 2-3

STUDY AREA

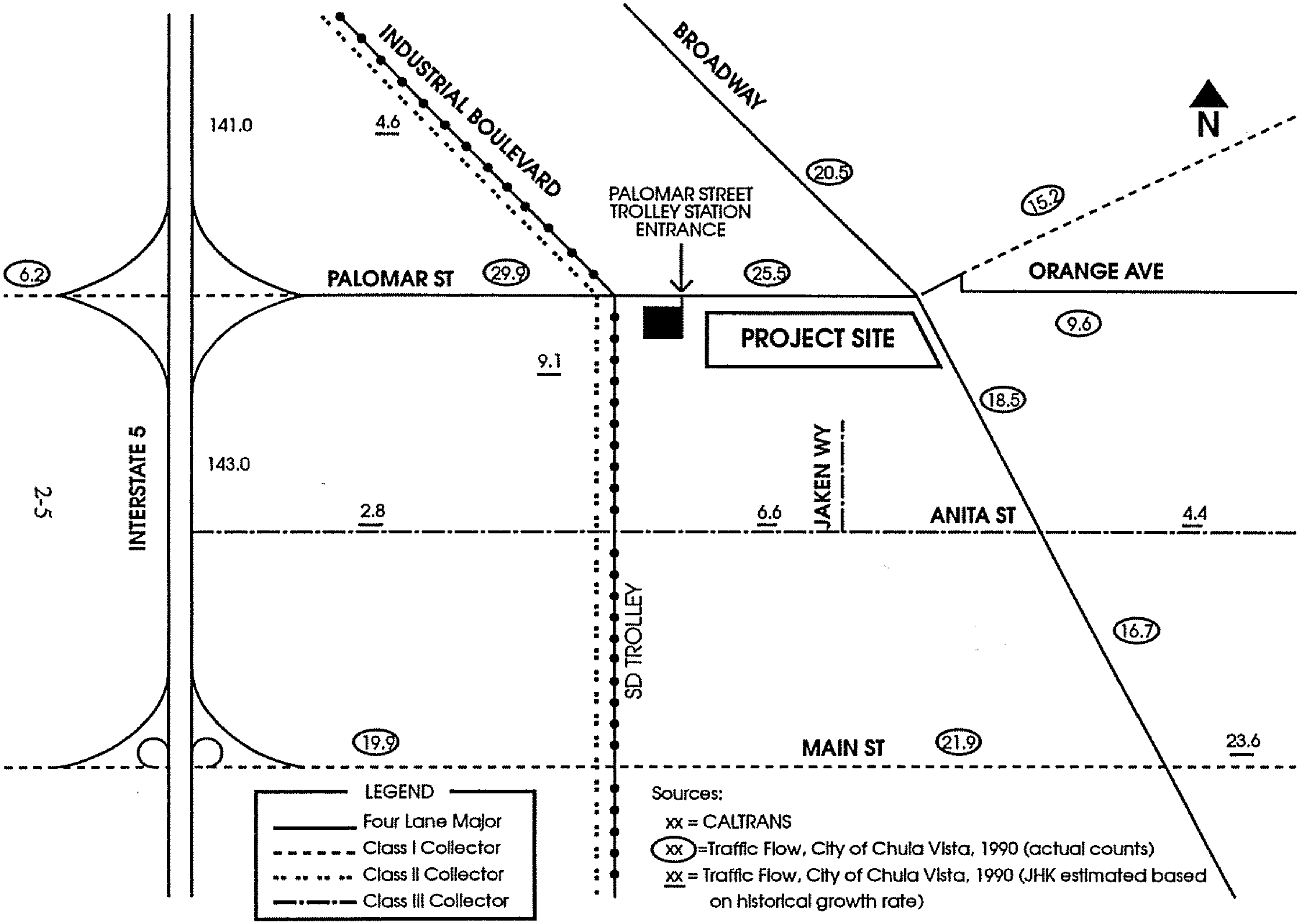

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Figure 2-4

EXISTING STREET NETWORK AND TRAFFIC VOLUMES
[illegible]

ADT volume of 6,200 vpd west of Interstate Route 5 and 29,900 vpd east of Interstate Route 5. Along the project site frontage, Palomar Street carries approximately 25,500 vpd, and east of Orange Avenue, Palomar Street has and ADT volume of 15,200 vpd. Between Industrial Avenue and Broadway, along the project site frontage, Palomar Street has four lanes, with a center left-turn lane. The intersections of Palomar Street/Industrial Boulevard, the Palomar Street /Trolley Station Entrance, Palomar Street/Broadway, and Palomar Street/Orange Avenue are controlled by traffic signals. The intersections of Palomar Street with the Interstate Route 5 entrance/exit ramps are currently controlled by stop signs on the freeway ramp approaches. However, these intersections will be signalized prior to the completion of the proposed project as a result of a joint City of Chula Vista/Caltrans and therefore, were analyzed as if they were currently signalized. It's improvement should be noted that the traffic signals at Palomar Street/ Industrial Boulevard and Palomar Street /Trolley Station Entrance are approximately 380 feet apart.

Broadway is a four-lane major street with north/south orientation. It extends from the National City limits south to the south San Diego city limits. Broadway is constructed with four travel lanes, turn lanes, and a raised median. North of Palomar Street, Broadway carries 25,000 vpd, between Palomar Street and Anita Street Broadway has an ADT volume of 18,500 vpd. Between Anita Street and Main Street, Broadway carries approximately 16,700 vpd. South of Main Street, Broadway has and ADT volume of 12,700.

Orange Avenue is a four-lane major street running in a east/west orientation. Orange Avenue extends from Palomar Street to the west to its eastern terminus east of Brandywine Avenue. East of the intersection Orange Avenue and Palomar Street, Orange Avenue carries approximately 9,600 vehicles per day.

Industrial Boulevard is a two-lane class II collector extending north/south from "L" Street and Coronado Avenue (in the City of San Diego Industrial acts as a frontage road for Interstate Route 5). The San Diego Trolley tracks run along the east side of this roadway for its entire length. Industrial Boulevard, north of Palomar Street carries approximately 4,600 vpd. Between Palomar Street and Anita Street, Industrial Boulevard has an ADT volume of 9,100 vehicles. Between Anita Street and Main Street, Industrial Boulevard carries approximately 8,500 vehicles per day. The intersection of Industrial Boulevard and Anita street, although currently unsignalized, is planned for signalization prior to the completion of the project, and is analyzed as if it was currently signalized.

Anita Street is a two-lane class III collector with east/west orientation. Anita Street extends from Interstate Route 5 to the west to Fresno Avenue. Anita Street carries approximately 2,800 vehicles per day east of Interstate Route 5. Between Industrial Boulevard and Broadway, Anita Street has an ADT volume of approximately 6,600. On-street parking is available on both sides of the street.

Main Street is a four-lane class I collector with east/west orientation extending from 19th Street to the west to Interstate Route 805, where it is renamed Otay Valley Road and continues east. Main Street, between Interstate Route 5 and Industrial Boulevard, carries 18,500 vpd. Between Industrial Boulevard and Broadway, Main Street carries 20,100 vpd. West of Broadway, Main Street carries approximately 19,400 vehicles per day.

San Diego Trolley

The San Diego Trolley runs parallel to Interstate Route 5 along the east side of the freeway through Chula Vista with a station at Palomar Street adjacent to the project site. The San Diego Trolley provides service between downtown San Diego and the International Border. The capacity of streets crossing the San Diego Trolley tracks (i.e., Palomar Street, Anita Street and Main Street) and nearby intersections are reduced due to stoppages in traffic as the trolley passes. This reduction in capacity is due to the impact of gate down time. The available supply of capacity during peak hours is reduced by the number of trolley crossings per hour. At the present time, approximately eight trolleys cross these arterials in the AM and PM peak hours. The accumulation of gate down times during either the AM or PM peak hours equals approximately seven minutes per hour. During this time down period, all traffic operations along the east-west arterials in the study are restricted, thus reducing available capacity. Over the course of a typical peak hour, gate down time operations represent a reduction in available capacity of approximately 12 percent.

It is important to recognize that the Metropolitan Transit Development Board (MTDB) anticipates the installation of electronic trolley vehicle tagging devices which would reduce gate down time at all at-grade crossings in the City of Chula Vista by September 1990. This reduction in gate down time would result in a savings of approximately 30 seconds per trolley crossing (for trolleys which stop at near-side stations in advance of the crossing gates) or 2 minutes of additional arterial and/or intersection capacity on the street system. This new device would restore approximately three percent capacity (or a total reduction of approximately 9 percent) to each intersection. However, in the near future (one to three years) MTDB anticipates adding trolley vehicles on the south line through Chula Vista. This increase in trolley frequency will negatively impact available capacity and result in an overall reduction in capacity.

As described in a letter of correspondence from Mr. Harold Rosenberg, City Traffic Engineer, dated November 16, 1990 to Urban Systems Associates, Inc., (See Appendix E), MTDB has informed the City of Chula Vista that they intend to increase the frequency of trains to eight per hour for each direction. Thus, in the future, there would be 16 periods when the gates would be down and stopping traffic on Palomar, Anita, and Main Streets. In other words, approximately one train would be crossing these east/west arterials every three minutes, restricting the movement of traffic for approximately 30 seconds per trolley crossing. This delay figure indicates that trolley operations will impact these arterials by reducing the amount of available capacity as calculated below:

16 Trolley Crossings X 30 Seconds/Crossing = 480 Seconds of Lost Capacity

$$\frac{\text{Total Seconds of Lost Capacity per Hour (480 Seconds)}}{\text{Total Available Seconds of Capacity per Hour (3600 seconds)}}$$

= 13.3 Percent Reduction of Available Capacity

However, with the trolley gate down, the traffic signals at the "E" Street/I-5 ramp intersections operate with flashing red signals. After stopping, traffic can legally move through the intersection if the vehicle's path is clear. For example, the eastbound to northbound left-turn movement at the I-5 northbound on-ramp can be made on the flashing red signal. Also, the northbound to westbound left-turn from the northbound off-ramp can be made after stopping. Therefore, the effect of the trolley gate operation is a reduction of less than 13.3 percent of intersection capacity. However, it is recommended that this minimal amount of extra capacity not be considered when reviewing trolley impacts.

To further clarify this issue, JHK has been directed by the City of Chula Vista to analyze critical intersections along Palomar Street adjacent to the trolley crossing using the "Operation Analysis" method described in the 1985 Highway Capacity Manual (HCM). This method will enable JHK to more accurately predict existing and future levels of service based on average delay per vehicle in seconds (see Chapter 9). Furthermore, this method allows for a precise analysis of trolley delay impacts at intersections immediately adjacent to the trolley crossing gates (i.e. Industrial Boulevard/Palomar Street).

Bus Service

San Diego Transit Local Route 32 provides bus service along Broadway, with connections to the "H" Street Trolley Station and the International Border Crossing, Chula Vista Transit Local Route 702 serves Palomar Street (and the Trolley Station) and provides connection to the "H" Street Trolley Station. Currently, this two-bus service makes 23 round trips daily.

In the near future (one to two years) Chula Vista Transit bus service to the Palomar Street Trolley Station will be increased to seven-bus service on three routes, making up to 84 round trips daily. In the two to three years there will be a 10-bus service on five routes making up to 126 round trips daily to and from the Palomar Street Trolley Station. Also, under consideration is the possible rerouting of MTDB administered Route 932 service from Bayfront/"E" Street Trolley Station to the Palomar Street Trolley Station, adding up to 32 round trips daily at this station.

PLANNED IMPROVEMENTS

Planned intersection improvements to the transportation network include the signalization and new striping improvements on the northbound and southbound ramps at Interstate Route 5 and Palomar Street. This signalization is expected to be complete prior to the completion of the proposed project, therefore our analysis assumes the implementation of this signalization improvement as part of the Existing Year 1990 Condition. In addition, the City of Chula Vista plans to signalize the intersection of Industrial Boulevard and Anita Street prior to the completion of the proposed project. Thus, this intersection was analyzed as signalized for the Existing Year 1990 Condition.

THRESHOLD STANDARDS

The following items identify the current "Threshold Standards" as they apply to the existing traffic conditions. These standards are taken from the City of Chula Vista Growth Management Plan, Exhibit "A" , Traffic Element, dated November 17, 1987 (Revised by JHK Year 1989 Traffic Monitoring Program Executive Summary Report).

Threshold Standard:

1. City-wide: Maintain LOS C or better at all intersections, with the exception that LOS D may occur at signalized intersections for a period not to exceed a total of two hours per day.

2. West of Interstate Route 805: Those signalized intersections which do not meet Standard #1 above, may continue to operate at their current (1987) LOS, but shall not worsen.

3. City-wide: No intersection shall operate at LOS E or F as measured for the average weekday peak hour.

Notes to Standards:

1. LOS measurements shall be for the average weekday peak hour, excluding seasonal and special circumstance variations.

2. The measurement of LOS shall be by the ICU (Intersection Capacity Utilization) calculation utilizing the City's published design standards.

3. The measurement of LOS at City arterial and freeway ramps shall be a growth management consideration in situations where proposed developments have a significant impact at interchanges.

4. Circulation improvements should be implemented prior to anticipated deterioration of LOS below established standards.

The determination of impact level is based on the City's Threshold Standards, as well as on standards generally applied throughout the U.S. On the average, national standards consider anything below a level of service D at signalized arterial intersections a significant impact. The City's Threshold Standards state that traffic operations at arterial signalized intersections which exceed a two-hour duration of future levels of service, this planning analysis of future impacts strived to achieve LOS C operations or better at all study area signalized intersection as directed by the City of Chula Vista. By following this guideline of providing mitigation measures to achieve LOS C operations at all arterial intersections based on future levels of service will be in conformance with the requirements of the City's Threshold Standards. Thus, levels of service D, E, or F are considered significant impacts.

At the present time, the City's Threshold Standards exclude signalized intersections located at freeway interchange ramps. However, the City's Growth Management Oversight Committee recommended that level of service D criteria be applied to ramp signals when a causal impact relationship can be shown and that these locations be included in the Threshold Standards. Thus, the I-5 ramp intersections should be limited to a level of service D for no more than two hours (same as required for City signalized intersections). However, since it is impossible to predict the duration of future levels of service and the fact that higher volume levels and and lower levels of service typically are anticipated at freeway ramp intersections, JHK has developed the following guideline for this analysis. Thus, for this planning analysis of future levels, LOS D operations at the freeway ramp intersections were considered acceptable while levels of service E and F are considered significant impacts.

3. ANALYSIS OF EXISTING TRAFFIC INTRODUCTION

This chapter describes the current condition of the circulation network in the study area. An analysis of roadway segments and critical intersections is presented. The purpose of this analysis is to document existing capacities and levels of service (LOS) on the network surrounding the proposed Palomar Trolley Center development project.

ROADWAY SEGMENT CAPACITY ANALYSIS

To provide a baseline condition for evaluating impacts on the circulation system, an analysis of existing operations on the study area roadway segments was completed. A summary of existing roadway classifications and daily traffic volumes for roadway segments in the project study area is provided. The majority of the roadways in the study area are classified as collector facilities, with the exception of Palomar Street, Broadway and Orange Avenue which are classified as four-lane major facilities for Year 1990 base conditions. The desired average daily traffic (ADT) volume levels for LOS C conditions for each functional classification of roadway are shown in Table 3-1. The basis for the development of this table was the Chula Vista General Plan Circulation Element (June 1989). Additional sources which provide further traffic engineering criteria used in the development of this table included the City of Chula Vista Street Design Standards (July 1988) and San Diego Association of Governments (SANDAG) regional modeling input parameters and guidelines.

Table 3-2 summarizes existing daily traffic volumes and desired roadway segment capacities for facilities in the study area. Table 3-2 also indicates the current volume to capacity ratio (V/C) for each segment under existing volume conditions based on the LOS C capacities. Currently the City of Chula Vista plans for LOS C operating conditions as a minimum for all Circulation Element facilities. The analysis gives an indication of the roadway's carrying capacity in relation to the City's minimum standards. It is not indicative of the actual (functional) capacity of the roadway. To more clearly define traffic operations and performance, the following analysis of the study area intersections is provided.

Table 3-2 shows that Palomar Street between I-5 and Industrial Boulevard currently operates over the recommended maximum design volume. The remaining roadway segments in the project study area have average daily traffic volumes under the recommended maximum design volumes.

Table 3-1

RECOMMENDED MAXIMUM
DESIGN VOLUME FOR LEVEL OF SERVICE C
AVERAGE DAILY TRAFFIC

Functional Class	Recommended Maximum Average Daily Design Volume
Freeway (8 LN)	130,560
Freeway (6 LN)	97,920
Freeway (4 LN)	65,280
Expressway (6 LN)	70,000
Prime Arterial (6 LN)	50,000
Major Street (6 LN)	40,000
Major Street (4 LN)	30,000
Class I Collector	22,000
Class II Collector	12,000
Class III Collector	7,500

Notes:

1. Levels of Service are not applied to residential streets since their primary purpose is to serve adjacent property and not to carry through traffic.
2. Levels of Service normally apply to facilities which carry through traffic between major trip generators and attractors

Source: City of Chula Vista Street Design Standards, SANDAG Guidelines, JHK & Associates.

Table 3-2

STREET CLASSIFICATIONS AND VOLUME TO CAPACITY RATIOS (V/C) EXISTING CONDITIONS - YEAR 1990

Roadway Segment	Year 1990 ADT	Recommended Maximum Design Volume (1)	V/C (2)
Palomar St. - Class I Collector			
Bay Blvd. - I-5	6,200	22,000	0.28
I-5 - Industrial Blvd.	29,900	22,000	1.36
Palomar St. -Four Lane Major			
Industrial Blvd. - Broadway	25,500	30,000	0.85
Broadway - Orange Ave.	26,800	30,000	0.89
Palomar Street - Class I Collector			
Orange Ave. - Fifth Ave.	15,200	22,000	0.69
Anita St.- Class III Collector			
Industrial Blvd.- Broadway	6,600	7,500	0.88
Broadway - Fifth Ave.	4,400	7,500	0.59
Main St. - Class I Collector			
Industrial Blvd. - Broadway	20,100	22,000	0.91
Industrial Blvd. - Class II Collector			
Naples St. - Palomar St.	4,600	12,000	0.38
Palomar St. - Anita St.	9,100	12,000	0.75
Broadway - Four-Lane Major			
Oxford St. - Palomar St.	20,500	30,000	0.68
Palomar St. - Anita St.	18,500	30,000	0.62
Anita St. - Main St.	16,700	30,000	0.56

Table 3-2 (Continued)
STREET CLASSIFICATIONS AND VOLUME TO CAPACITY RATIOS (V/C) EXISTING CONDITIONS - YEAR 1990

Roadway Segment	Year 1990 ADT	Recommended Maximum Design Volume (1)	V/C (2)
Orange Ave. - Four-Lane Major			
Palomar Street - Fifth Ave.	9,600	30,000	0.32

Notes: 1. Currently the City of Chula Vista plans for LOS C conditions as a maximum design volume on all Circulation Element facilities.

2. The v/c ratio is based on the capacity of the roadway segment at LOS C. Thus, it gives an indication of the roadway's carrying capacity in relation to the City's minimum standards. It is not indicative of the actual (functional) capacity of the roadway.

Source: Existing Year 1990 ADT data was derived from Chula Vista Traffic Counts (Traffic Flow Report, November 12, 1990).

INTERSECTION CAPACITY ANALYSIS

To analyze existing (Year 1990) conditions, turning movement volumes at key intersection were compiled from previous traffic studies completed in the study area. Figure 3-1 shows existing lane configurations for each intersection included in this analysis. Due to the proposed land uses (primarily retail/commercial), it was determined that the PM peak hour was critical since only a minimal amount of commercial traffic is expected during the morning peak hour (7:00 - 9:00). Analyzing the peak hour is important because this generally places the highest demand on the surrounding street system. The existing PM peak hour turning movement volumes shown on Figure 3-2 were taken from the following sources:

- Reanalysis of the Palomar Trolley Center Traffic Analysis, by Willdan Associates, JHK & Associates, 1990.
- Project Report - Interstate Route 5/Palomar Street Interchange, Caltrans, 1990
- Montgomery Traffic Analysis, JHK & Associates, 1990
- Traffic Analysis for Palomar Trolley Center, Willdan Associates, 1988

For the intersection of Industrial Boulevard and Anita Street, the counts taken by Willdan Associates on November 6, 1988, were expanded by a growth rate of three percent to reflect Year 1990 conditions.

SIGNALIZED INTERSECTION CAPACITY ANALYSIS METHODOLOGY

Level of Service for the PM peak hours was calculated using the Intersection Capacity Utilization (ICU) method. The ICU method is the ratio of intersection demand to capacity calculated by summing the ratios of demand to capacity for the critical movement. For this analysis, a capacity of 1,700 vehicles per hour (vph) was assumed for through movement and a capacity of 1,500 vph was assumed for turning movements. The following table summarizes the ranges of ICU for each level of service.

Level of Service	ICU Ranges
A	0.00 - 0.60
B	0.61 - 0.70
C	0.71 - 0.80
D	0.81 - 0.90
E	0.91 - 1.00
F	Greater than 1.01

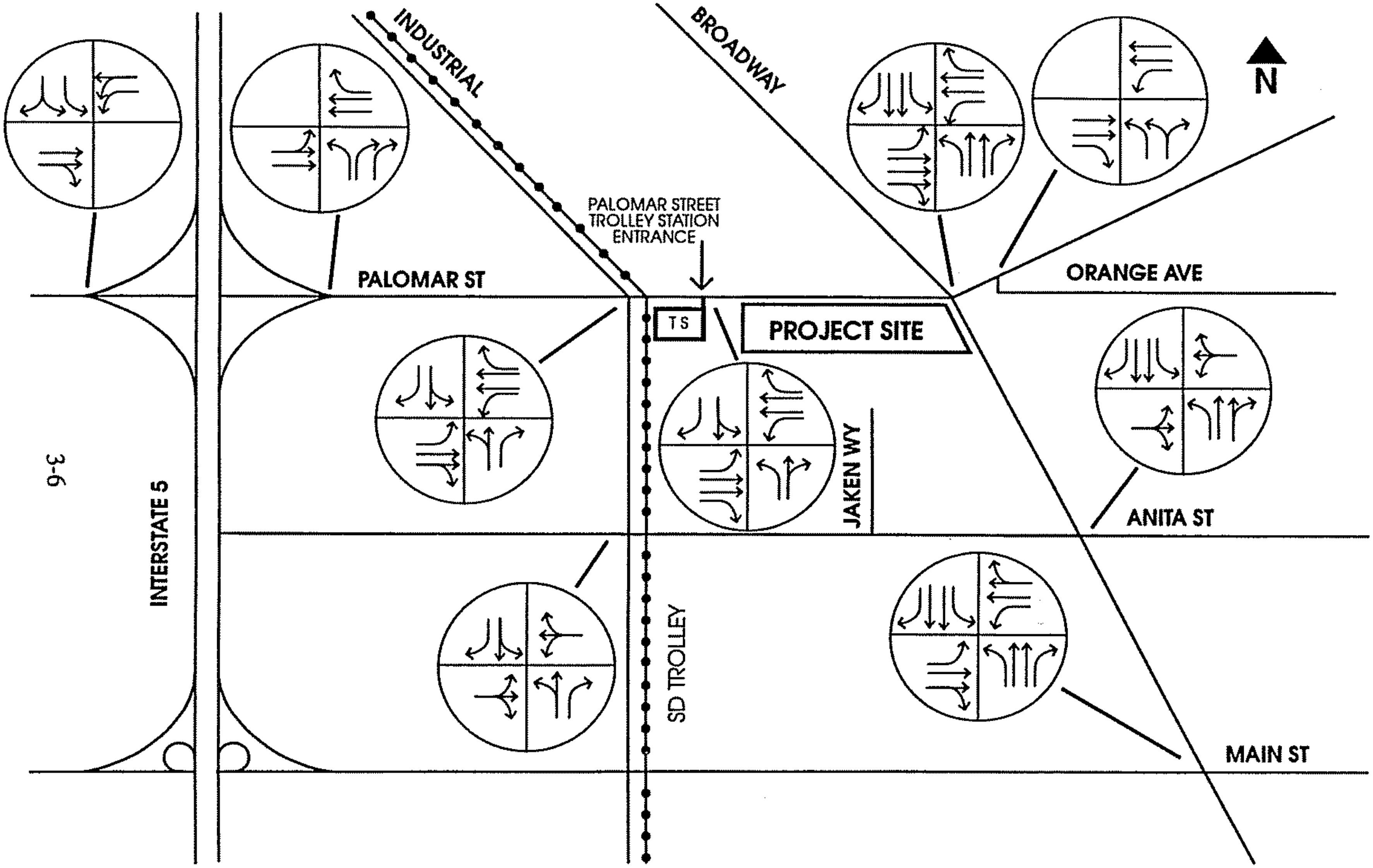

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Figure 3-1

EXISTING GEOMETRICS
YEAR 1990

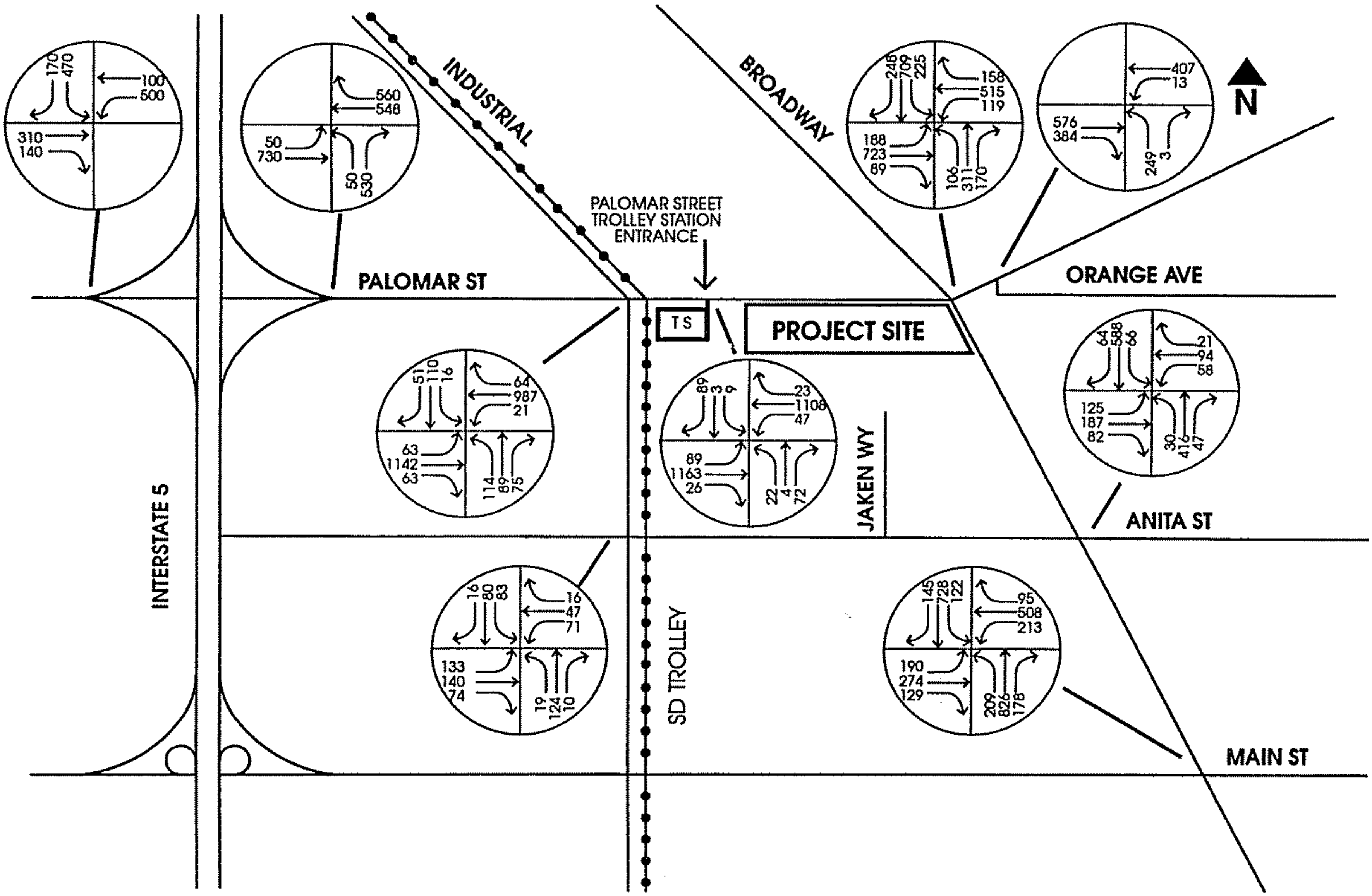

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Figure 3-2

PM PEAK HOUR TURNING MOVEMENT VOLUMES
YEAR 1990

Table 3-3 lists the existing levels of service at the intersection in the study area. The intersections of Palomar Street/Interstate Route 5 Southbound, Palomar Street/Trolley Station Entrance, Palomar Street/Orange Avenue, Broadway/Anita Street and Industrial Boulevard/ Anita Street currently operate at LOS A. The intersections of Palomar Street/Interstate Route 5 Northbound, Palomar Street/Industrial Boulevard, and Palomar Street/Broadway currently operate at LOS B. The intersection of Broadway/Main Street currently operates at LOS C.

Table 3-3
EXISTING LEVELS OF SERVICE
YEAR 1990 CONDITIONS
PM PEAK HOUR

Intersection	ICU	LOS
I-5 Southbound/Palomar Street	0.53	A
I-5 Northbound/Palomar Street	0.67	B
Industrial Boulevard/Palomar Street	0.60	B*
Trolley Station Entrance/Palomar Street	0.55	A
Broadway/Palomar Street	0.66	B
Orange Avenue/Palomar Street	0.47	A
Broadway/Anita Street	0.57	A
Broadway/Main Street	0.83	C
Industrial Boulevard/Anita Street	0.44	A

Note: *The calculated ICU for this intersection is 0.604, which is greater than the recommended ICU range for LOS A (0.600). Therefore this intersection operates at LOS B.

CONFORMANCE WITH THRESHOLD STANDARDS

As shown on Table 3-3, all study area intersections currently operate at LOS C or better except the intersection of Broadway/Main Street (0.83, D). Thus, partial conformance with the adopted standards is achieved for existing conditions.

4. FUTURE YEAR 1992 CONDITIONS

The following chapter discusses future Year 1992 traffic conditions without the project for both roadway segments and intersections. The Future Year 1992 conditions assumes that traffic in the study area has an annual growth rate of three percent.

ROADWAY SEGMENT ANALYSIS - YEAR 1992 WITHOUT PROJECT

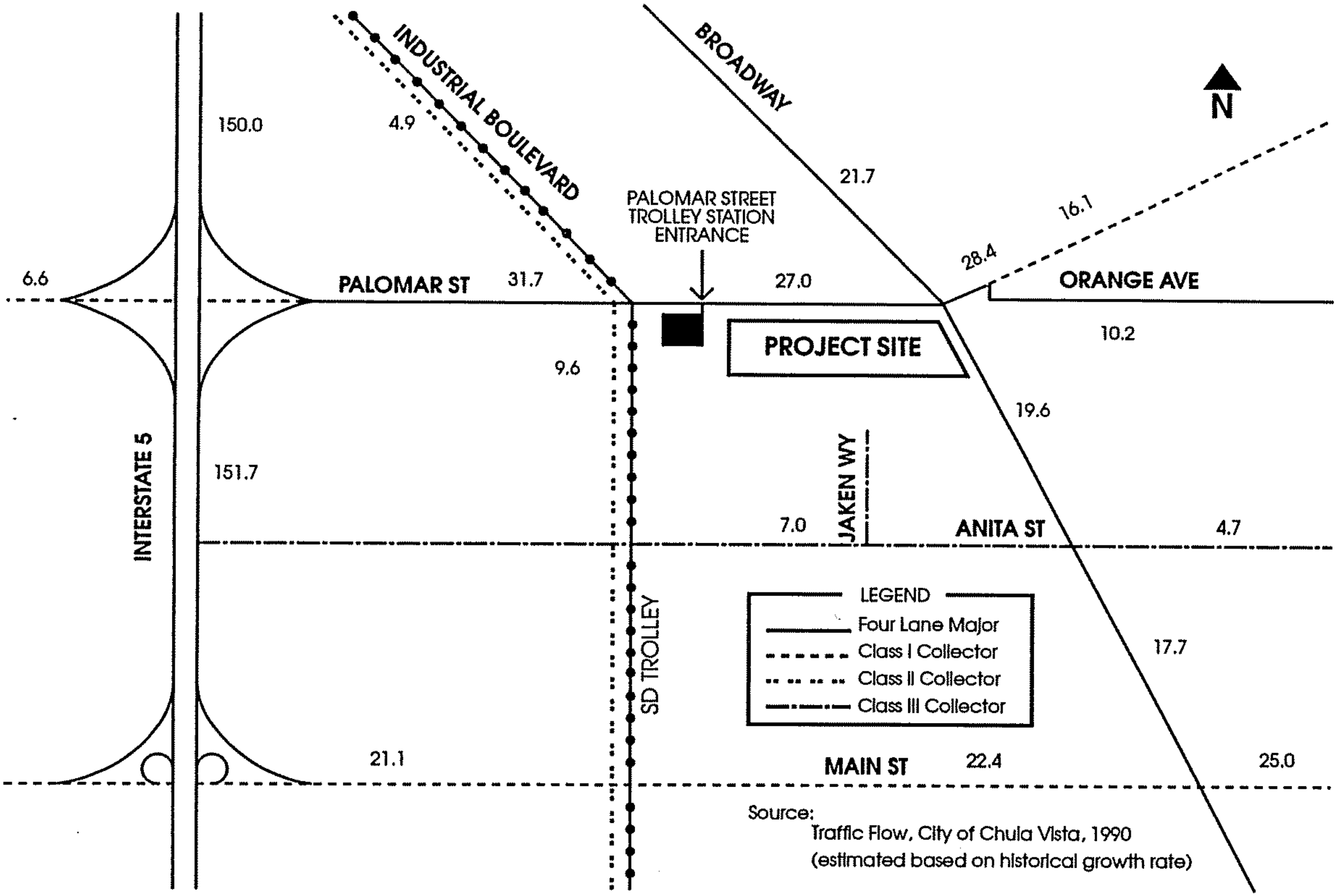
Figure 4-1 shows the Future Year 1992 transportation network and traffic volumes without project generated trips. Table 4-1 shows the Future Year 1992 roadway segment classifications and volume-to-capacity ratios. Existing Year 1990 conditions are included for comparison. This table shows that the roadway segment of Palomar Street between I-5 and Industrial Boulevard will operate in Year 1992 above the maximum recommended design volume.

INTERSECTION CAPACITY ANALYSIS - YEAR 1992 WITHOUT PROJECT

Figure 4-2 shows the Future Year 1992 turning movement volumes for the PM peak hour without project trips. Table 4-2 shows the future Year 1992 intersection capacity utilization (ICUs) and levels of service for this Future Year 1992 condition without the project. Existing Year 1990 intersection levels of service are included for comparison. This analysis indicates that all study area intersections will operate at acceptable levels of service during the PM peak hour in Year 1992 without the project.

CONFORMANCE WITH THRESHOLD STANDARDS

As shown on Table 4-2, all study area intersections are projected to operate at LOS C or better except the intersection of Broadway/Main Street (0.87, D). Thus, partial conformance with the adopted standards is achieved for Future Year 1992 without project condition.



Palomar Trolley Center

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Figure 4-1

FUTURE NETWORK AND AVERAGE DAILY TRAFFIC VOLUMES (IN THOUSANDS) WITHOUT PROJECT TRIPS YEAR 1992

Table 4-1 (Continued)

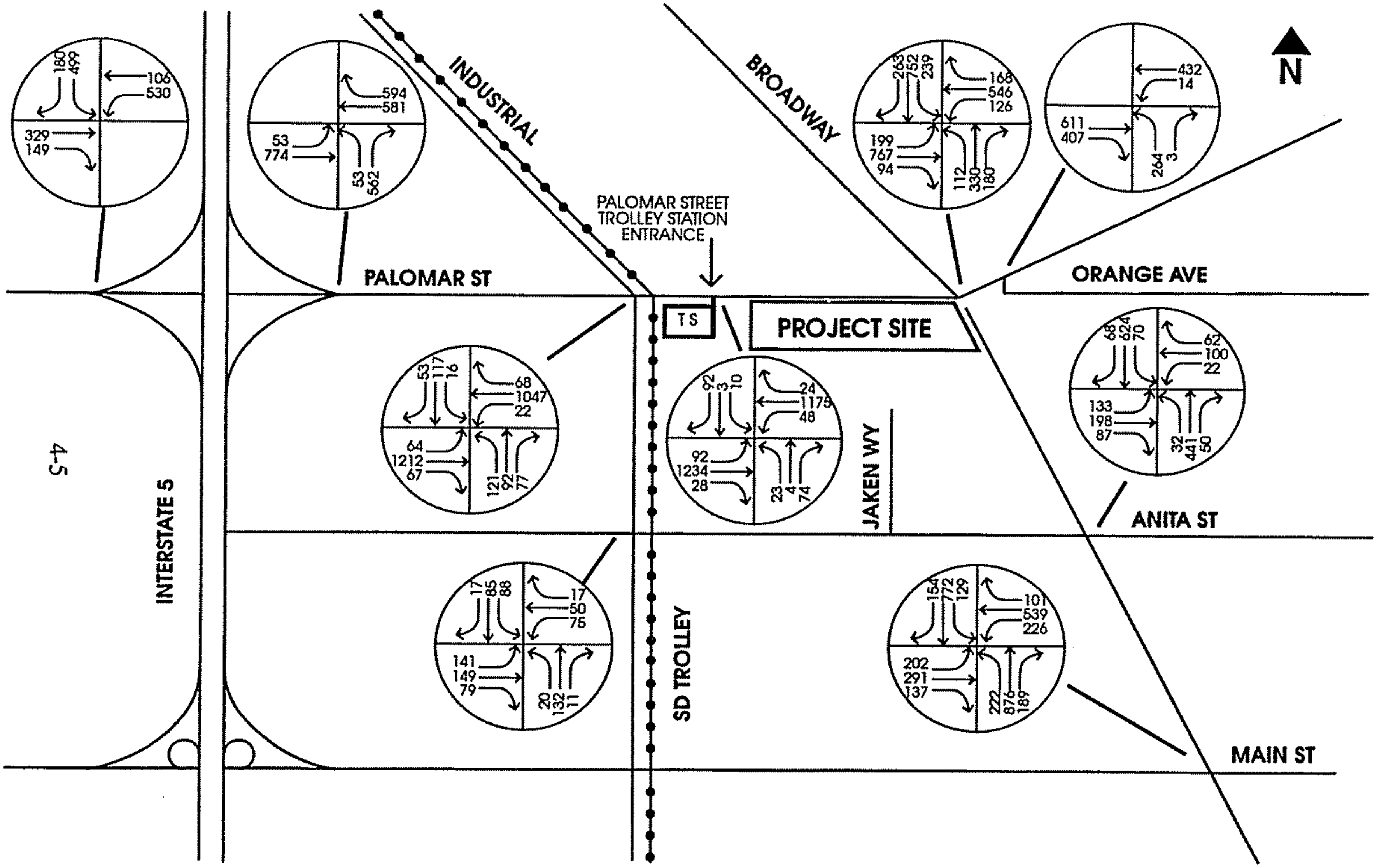
STREET CLASSIFICATIONS AND VOLUME TO CAPACITY RATIOS (V/C) FUTURE CONDITIONS WITHOUT PROJECT- YEAR 1992

Roadway Segment	Year 1992 ADT	Recommended Maximum Design Volume (1)	Year 1992 V/C (2)	Year 1990 V/C (2)
<u>Orange Ave. - Four-Lane Major</u>				
Palomar Street - Fifth Ave.	10,200	30,000	0.34	0.32

Notes: 1. Currently the City of Chula Vista plans for LOS C conditions as a minimum for all Circulation Element facilities.

2. The v/c ratio is based on the capacity of the roadway segment at LOS C. Thus, it gives an indication of the roadway's carrying capacity in relation to the City's minimum standards. It is not indicative of the actual (functional) capacity of the roadway.

Source: Future Year 1992 ADT data was derived from Chula Vista Traffic Counts (Traffic Flow Report, November 12, 1990).



Palomar Trolley Center

Traffic Impact Analysis

jhk & associates

Figure 4-2

**PM PEAK HOUR TURNING MOVEMENT VOLUMES
WITHOUT PROJECT TRAFFIC
YEAR 1992**

5. TRIP GENERATION AND DISTRIBUTION

In order to evaluate the potential project and impacts, we have estimated the trips we would expect to be generated from the proposed project.

The traffic which will result from the proposed project is estimated using accepted trip generation rates and peak hour factors which are based on categories of land uses. These rates have been developed by various agencies and summarized by SANDAG in their Traffic Generators manual. According to SANDAG, the 198,200 square foot commercial site will generate a total of 70 trips per 1,000 square feet of gross floor area (GFA). Some of these trips, however will already be on the street system and are either linked with other trips or stopover trips, known as "passerby" trips. The City of San Diego has completed research on passerby or linked trips, by conducting detailed surveys at similar sites in the City of San Diego. Linked trips refer to a driver stopping at a commercial establishment on their way home from another trip, then continuing home. Therefore, the trip is already on the street system, and should not be "double counted" by the gross traffic generation rate. The recommended cumulative or linked trip rate for a community shopping center (100,000 - 300,000 square feet of GFA) is 49 trips per 1,000 square feet (per August 22, 1990, report from Urban Systems Associates report). This trip reduction was verbally agreed upon by the City of Chula Vista Traffic Engineer (Mr. Harold Rosenberg, January 5, 1991).

Based on these trip generation rates, the proposed project will generate 9,712 new ADT with 972 PM peak hour trips (splitting evenly inbound and outbound trips).

The City of Chula Vista has requested that this report predict trip generation figures for the project with the replacement of 48,000 square feet of commercial space with a 48,000 square foot bowling alley. This would increase the project ADT to 10,677 trips. This increase is due to the unlikelihood of passerby trips for bowling alleys. The SANDAG manual of Traffic Generators indicates that a bowling alley would generate 300 trips per acre or 69 trips per 1,000 square feet. This use is predicted to generate 3,307 trips a day with ten percent or 330 trips occurring during the peak hour. The addition of this use to the project would increase the project impact by approximately ten percent. The remainder of this report assumes that the project will consist entirely of commercial uses.

TRIP DISTRIBUTION

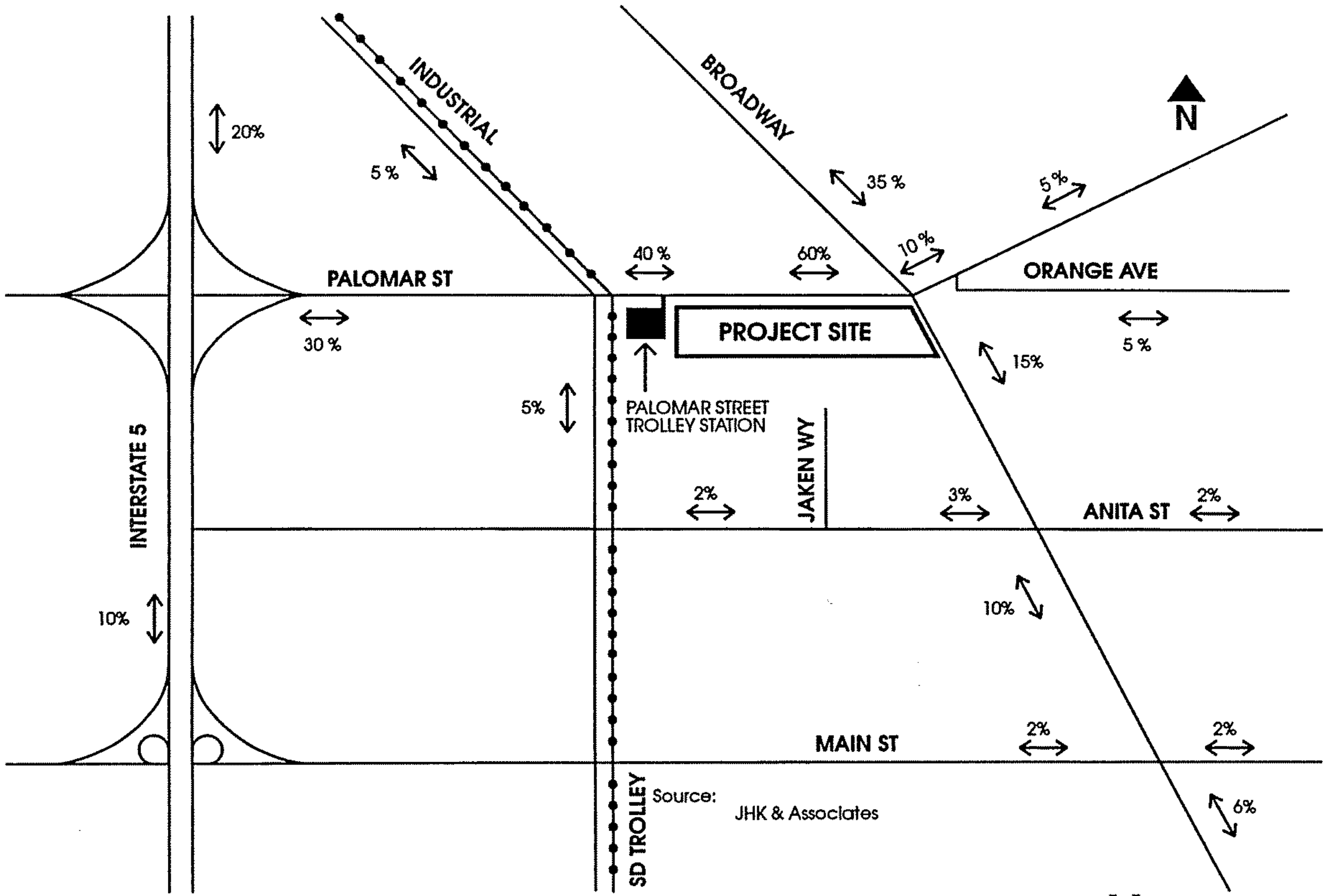
The distribution of trips generally results from an estimated of ultimate travel destinations and which elements of the street system would be used to reach those destinations. The basis for this recognition is the driver's consideration of time, distance, and convenience in choosing a route. Attractions include work areas, shopping centers, schools, parks, and public buildings. A major element is the interaction between commercial centers and residential areas.

Trip distribution for the proposed project was based on the previous traffic studies for this project (Willdan, 1988, JHK & Associates, 1989). This distribution was based on a select zone assignment (for the project zone) performed by SANDAG. JHK & Associates has revised this distribution to include Interstate Route 5, Anita Street, and Main Street in the analysis. Figure 5-1 shows the Future Year 1992 distribution of trips to and from the proposed project site.

As shown, the majority of trips (60 percent) will orient to and from the east along Palomar Street, before splitting 35-15 percent north and south along Broadway, respectively and 10 percent continuing east along Palomar Street and Orange Avenue. Forty percent would orient to and from the west, before splitting five to five percent north and south respectively. Of the remaining 30 percent, 20 percent would travel north on Interstate Route 5 while 10 percent would travel south.

ASSIGNMENT OF PROJECT TRIPS

Figure 5-2 shows the assignments of new daily and PM peak hour trips generated by the proposed project. Figure 5-3 shows the cummulative assignment of all daily and PM peak hour trips generated by the proposed project. Figure 5-4 shows the Future Year 1992 projected daily traffic volumes including project traffic.

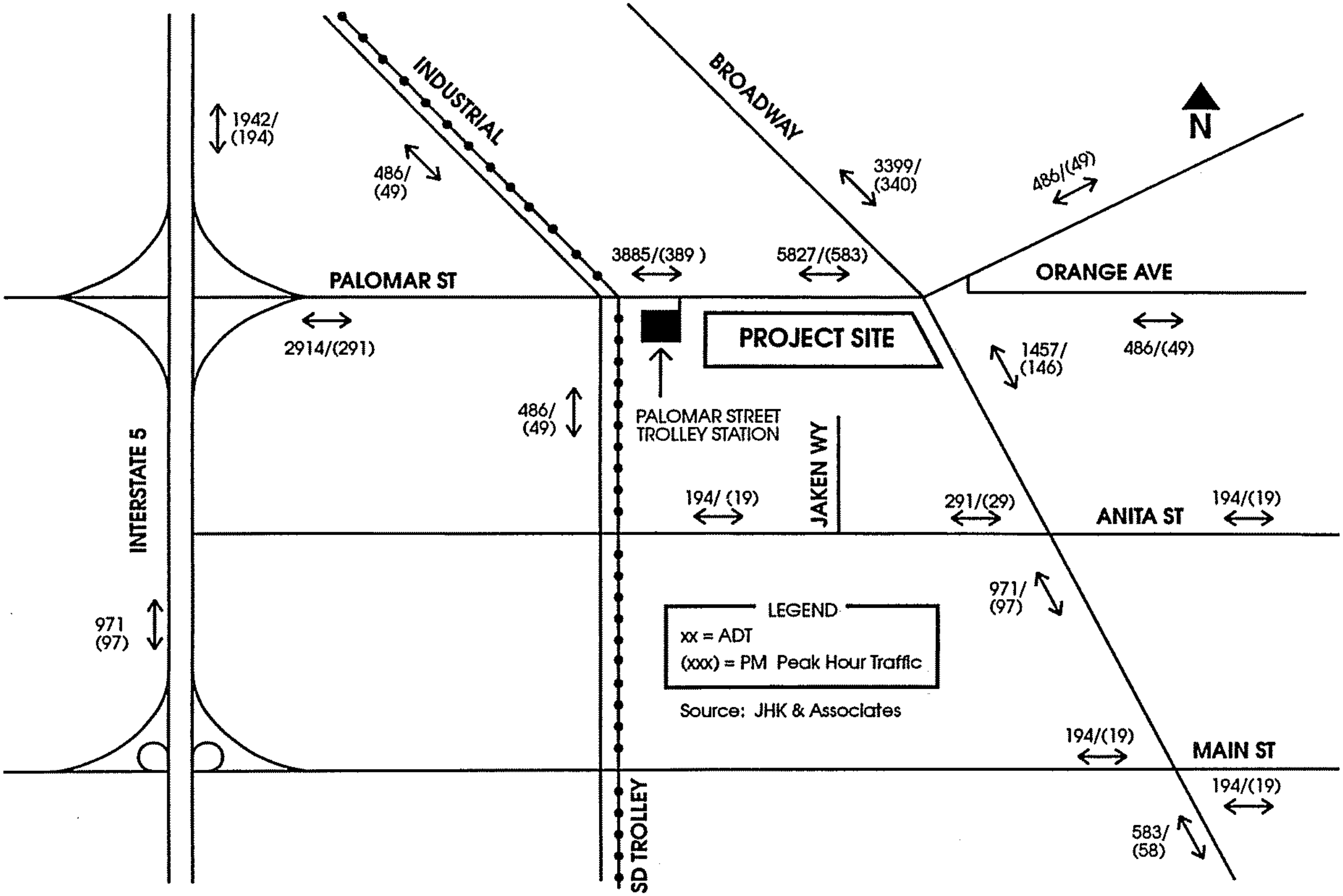


Palomar Trolley Center
Traffic Impact Analysis

jhk & associates

Figure 5-1

TRIP DISTRIBUTION FOR PROPOSED PROJECT
YEAR 1992



Palomar Trolley Center

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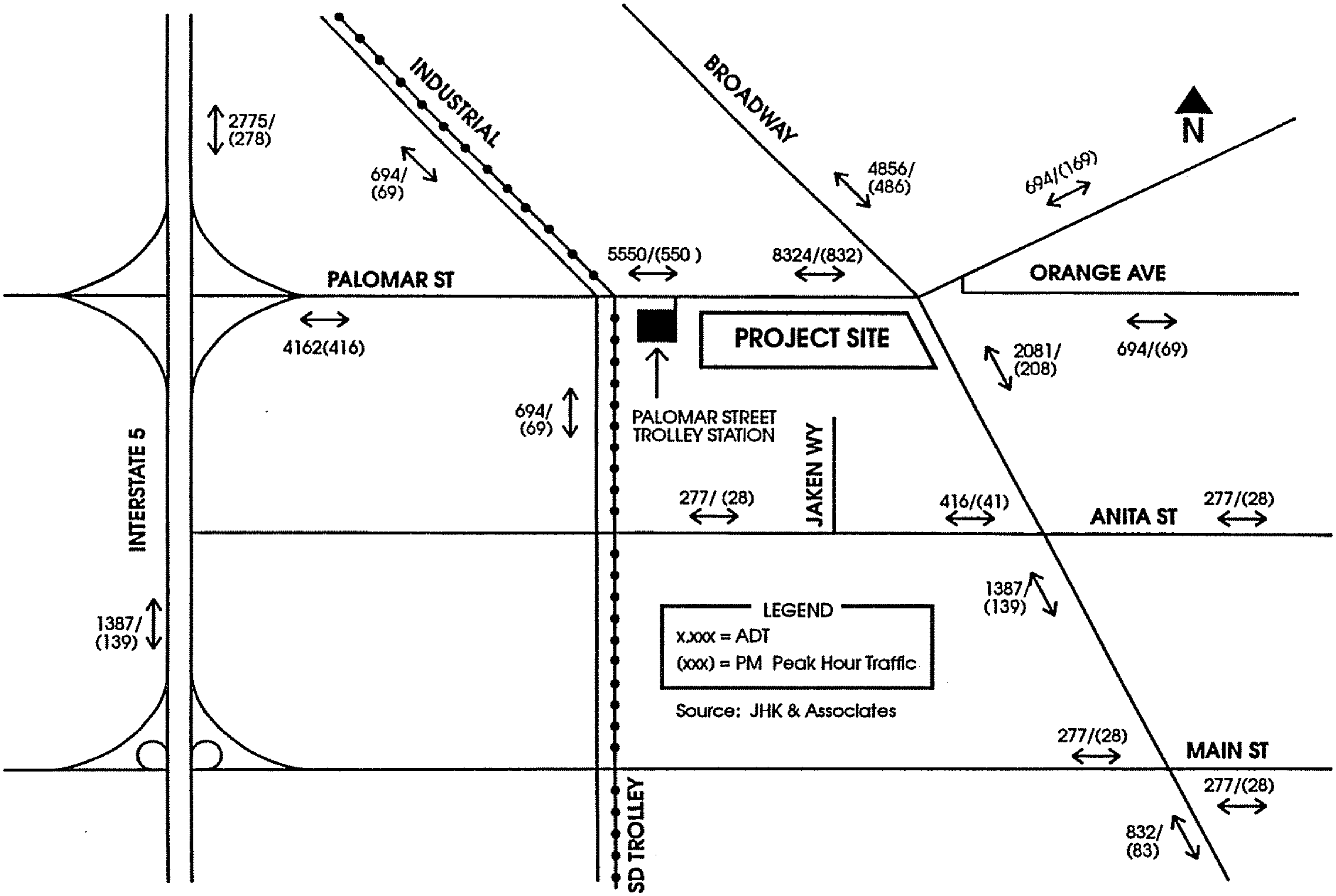
Figure 5-2

PROJECT GENERATED TRAFFIC ASSIGNMENT (NEW TRIPS)
DAILY AND PM PEAK HOUR
YEAR 1992



Palomar Trolley Center

Traffic Impact Analysis

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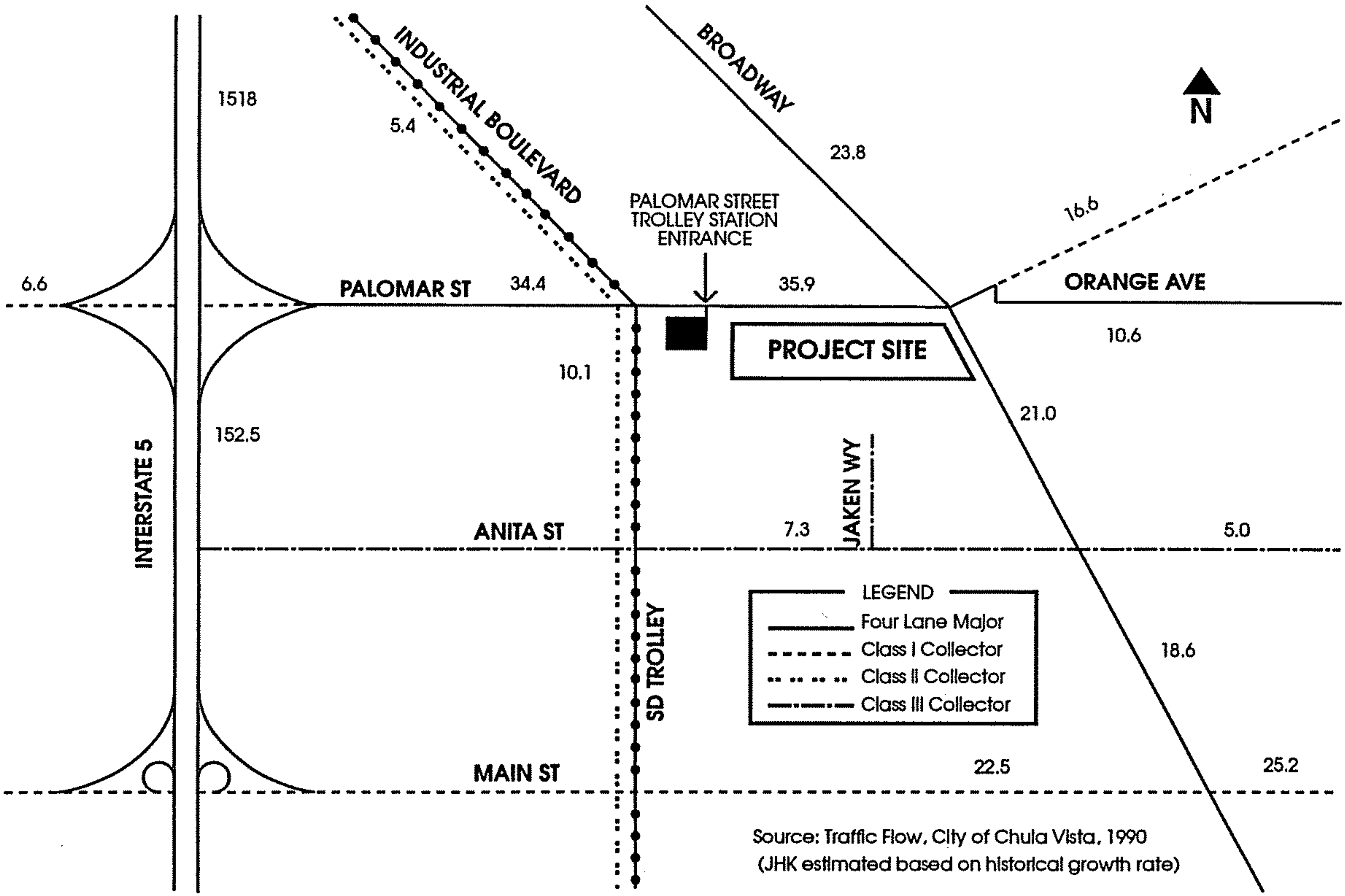
Figure 5-3

PROJECT GENERATED TRAFFIC ASSIGNMENT (ALL TRIPS)
DAILY AND PM PEAK HOUR
FUTURE YEAR 1992



Palomar Trolley Center

Traffic Impact Analysis

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Figure 5-4

FUTURE NETWORK AND AVERAGE DAILY TRAFFIC VOLUMES (IN THOUSANDS) WITH PROJECT GENERATED TRIPS YEAR 1992

6. ANALYSIS OF PROJECT IMPACTS

The following chapter presents an analysis of roadway segment and intersection operations predicted for Year 1992 with the addition of project generated traffic.

ROADWAY SEGMENT ANALYSIS - YEAR 1992 CONDITIONS WITH PROJECT TRAFFIC

Table 6-1 provides a summary of Future Year 1992 roadway segment volume-to-capacity ratios with project generated traffic loaded on the transportation network.

INTERSECTION CAPACITY ANALYSIS - YEAR 1992 CONDITIONS WITH PROJECT TRAFFIC

For this analysis, it was important to assign approximate percentages of project generated traffic to the five access points to the development. Since the Trolley Station entrance is only 380 feet away from the traffic signal it was assumed to only attract five percent of the total project generated traffic. The main signalized entrance to the project was assigned approximately 65 percent of the project traffic. The remaining three unsignalized driveways were assigned the remaining 30 percent of the project generated traffic.

A peak hour signal warrant analysis was conducted on the Project Entrance/Palomar Street intersection using Projected PM peak hour entering volumes with project traffic included. This analysis indicated that due to the projected high volume on Palomar Street, a traffic signal is warranted at this intersection. Therefore, for the Future Year 1992 condition with the project, this intersection was assumed to be signalized.

Figure 6-1 shows the Projected Year 1992 intersection geometrics with project entrance included. Figure 6-2 shows projected Year 1992 intersection turning movement volumes with project traffic added to the network. Table 6-2 summarizes the intersection ICU analysis results and the expected levels of service for the study area intersections.

This analysis reveals that only the intersections of Palomar Street/Project Entrance and Palomar Street/Broadway are significantly impacted by the proposed project. The intersection of Broadway/Main Street operates at LOS D. However, the project impact is negligible. The remaining intersections will operate within the City of Chula Vista standards for acceptable levels of service (LOS A - C) in Year 1992 with the project traffic added.

Recommended mitigation measures for the project impacted intersections are discussed in Chaper 8.

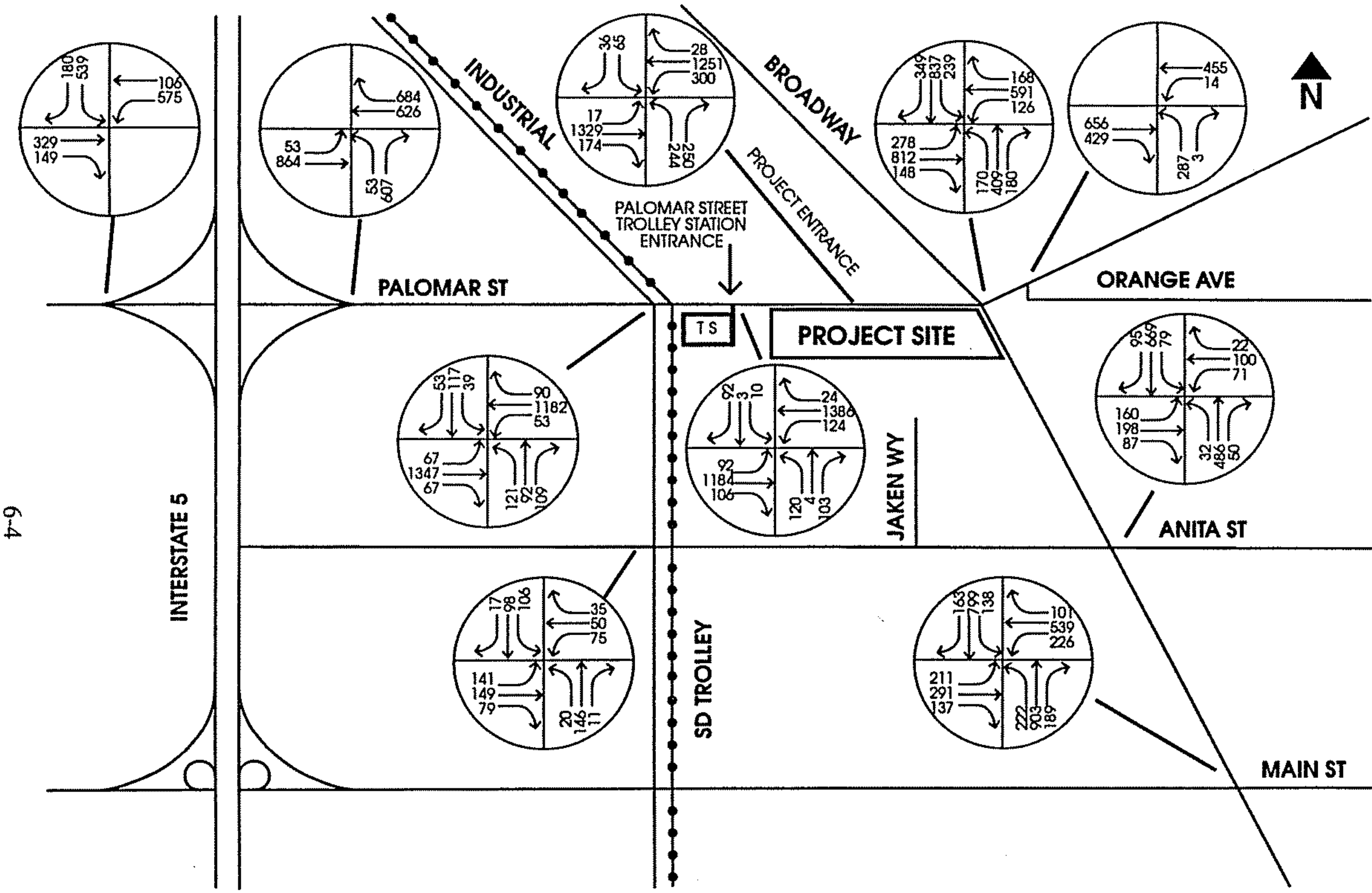
Table 6-1 (Continued)

STREET CLASSIFICATIONS AND VOLUME TO CAPACITY RATIOS (V/C) FUTURE CONDITIONS WITH AND WITHOUT PROJECT- YEAR 1992

Roadway Segment	Year 1992 ADT	Recommended Maximum Design Volume (1)	With Project V/C (2)	Without Project V/C (2)
<u>Orange Ave. - Four-Lane Major</u>				
Palomar St. - Fifth Avenue	10,600	30,000	0.35	0.32

Notes:
1. Currently the City of Chula Vista plans for LOS C conditions as a minimum for all Circulation Element facilities.
2. The v/c ratio is based on the capacity of the roadway segment at LOS C. Thus it gives an indication of the roadway's carrying capacity in relation to the City's minimum standards. It is not indicative of the actual (functional) capacity of the roadway.

Source: Future Year 1992 ADT data was derived from Chula Vista Traffic Counts (Traffic Flow Report, November 12, 1990).



Palomar Trolley Center

Traffic Impact Analysis

jhk & associates

Figure 6-1

**PM PEAK HOUR TURNING MOVEMENT VOLUMES
WITH PROJECT TRAFFIC
YEAR 1992**

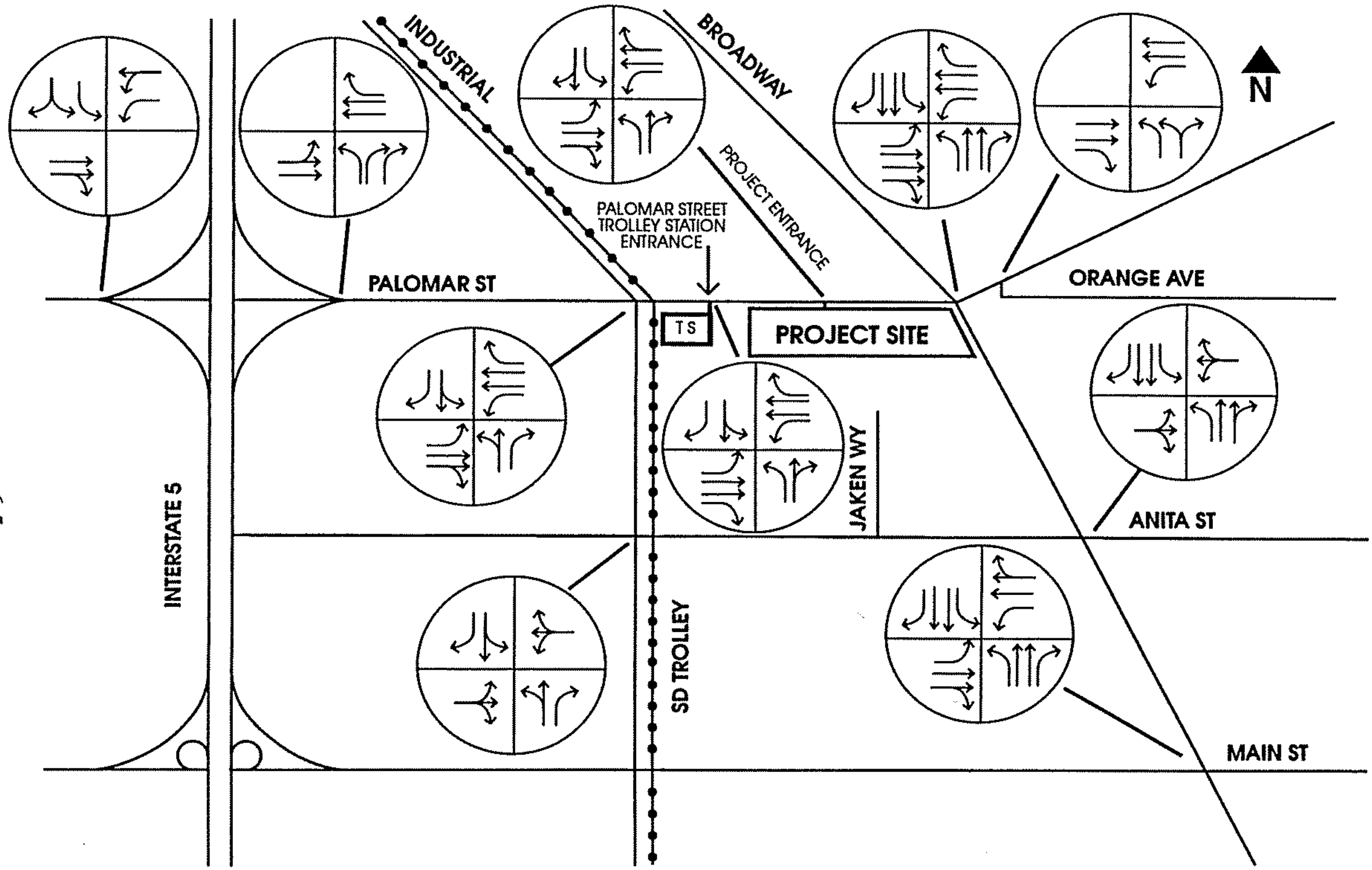


Figure 6-2

FUTURE GEOMETRICS WITH NEW TROLLEY CENTER
MAIN ENTRANCE/YEAR 1992

Table 6-2

INTERSECTION CAPACITY UTILIZATION (ICU)
AND LEVEL OF SERVICE (LOS)
FOR STUDY AREA INTERSECTIONS
PM PEAK HOUR YEAR 1992

WITH AND WITHOUT PROJECT TRAFFIC

Intersection	Year 1992 With Project ICU	Year 1992 With Project LOS	Year 1992 Without Project ICU	Year 1992 Without Project LOS
I-5 Southbound/Palomar St.	0.59	A	0.55	A
I-5 Northbound/Palomar St.	0.78	C	0.70	C*
Industrial Boulevard/Palomar St.	0.69	B	0.63	B
Trolley Station Entrance/Palomar St.	0.71	C	0.58	A
Project Entrance/Palomar St.	0.93	E	0.44	A
Broadway/Palomar St.	0.82	D	0.69	B
Orange Ave./Palomar St.	0.51	A	0.49	A
Broadway/Anita St.	0.64	B	0.60	B**
Broadway/Main St.	0.87	D	0.87	D
Industrial Boulevard/Anita St.	0.48	A	0.46	A

Note: *The calculated ICU for this intersection is 0.704, which is greater than the recommended ICU range for LOS B (0.700). Therefore this intersection is expected to operate at LOS C.

**The calculated ICU for this intersection is 0.604, which is greater than the recommended ICU threshold for LOS A (0.600). Therefore, this intersection is expected to operate at LOS B.

CONFORMANCE WITH THRESHOLD STANDARDS

As shown on Table 6-2 all study area intersections are expected to operate at LOS C or better, except the following three intersections:

- Palomar Street/Project Entrance (ICU 0.93, LOS E)
- Palomar Street/Broadway (ICU 0.82, LOS D)
- Main Street/Broadway (ICU 0.82, LOS D)

Thus, partial conformance with the adopted standards is achieved for the Future Year 1992 with project condition. The above mentioned intersections are not in conformance with the adopted standards and will require mitigation improvements.

PROJECT IMPACTS - BUILDOUT

The City of Chula Vista General Plan Circulation Element is based on buildout travel forecasts using the adopted buildout Land Use Element to estimate future street classifications required to accommodate travel demand. Forecast volumes for the street network in the project vicinity indicate future volumes will stabilize at today's levels or decrease. This seems reasonable, because land uses in the project vicinity are virtually buildout today, and future development in this area would be a result of redevelopment. Also, with buildout of planned land uses in the City's eastern area, some existing traffic could be redistributed. Therefore, we will consider the Future Year 1992 with project condition as the worst-case analysis. It should be noted, that volumes along Interstate 5 will be much higher than today. This is a result of future development in the Otay Mesa area.

7. PARKING, ACCESS, AND INTERNAL CIRCULATION PARKING

For a community shopping center such as the proposed project, the City of Chula Vista requires one space per 200 square feet or five spaces per 1,000 square feet. With 198,200 square feet of commercial/retail space, the proposed requires 991 spaces. The proposed project includes a planned surface lot with 991 spaces, in accordance with the City of Chula Vista standards.

ACCESS AND INTERNAL CIRCULATION

In addition to the signalized intersections at the central driveway and existing Trolley Entrance, two other access points will be provided that are restricted to right-turns in and right-turns out, in conjunction with a raised median on Palomar Street. One access point will be located to the east of the site on Broadway with right and left-turns in and right-turns out only. Internal circulation will be provided by an inner loop road around the shopping center connected by a series of parking aisles.

8. MITIGATION

The proposed Palomar Trolley Center will add approximately 9,712 newly generated ADT to the surrounding street system, with 971 trips occurring during the PM peak hour. The distribution of trips is estimated to be split 40 percent east and 60 percent west along Palomar Street. The following sections discuss proposed mitigation measures for the project. This chapter concludes with a presentation of Mitigation Findings which summarize the improvements required to fully mitigate forecasted project impacts.

PROJECT ALTERNATIVE - REDUCTION IN PROJECT SIZE

One of the alternatives to the proposed project was the 10 percent reduction in square footage of the project floor area. This reduction would decrease project generated ADT to 8,741 trips per day and PM peak hour trips to 874. JHK & Associates analyzed this reduction in project trips at the two intersections with failing levels of service (Broadway/Palomar Street and Broadway/Main Street). At the intersection of Broadway and Palomar, with existing geometrics, intersection levels of service improved from LOS D (0.82 ICU) to LOS C (0.80 ICU). At the intersection of Broadway and Main Street intersection level of service improved from LOS D (0.82 ICU) to LOS C (0.79 ICU). Based on this analyses, the 10 percent reduction would only be effective at the Broadway/Main Street intersection. JHK & Associates did not analyze the impacts of the reduced intensity alternatives on the other study area intersections because they are expected to operate at acceptable levels with the project as proposed.

JHK & Associates also analyzed the impact of this reduction in trips on the roadway segments with poor levels of service in Year 1992 with project trips. This analysis revealed that the reduction in ADT on the roadway segments of Palomar Street from Interstate Route 5 to Orange Avenue, and Main Street, from Industrial Boulevard to Broadway to have virtually no affect.

The following sections describe possible mitigation measures include geometric improvements that will improve operations on the transportation network in Year 1992 with the addition of project traffic.

ADDITIONAL PROJECT ACCESS VIA JAYKEN WAY/ANALYSIS

One of the alternatives for the proposed project was the provision of an additional access point via Jayken Way. This site access would be primarily used by local residents familiar with the area. JHK analyzed the impact of this additional access point on study area intersections. This analysis concluded that the Jayken Way entrance would attract at the most five percent of the total project trips, and would have virtually no effect on roadway segment or intersection operations or levels of service. The results of this alternative analysis and the reduction in Project Size Alternative are included in Appendix D.

ROADWAY SEGMENTS

Street segments in the project vicinity currently operate at acceptable volume-to-capacity ratios, with the exception of Palomar Street between Interstate Route 5 and Orange Avenue. When the future growth in traffic and the proposed project is added, Palomar Street volume-to-capacity-ratios are expected to deteriorate further. However, the City of Chula Vista General Plan Circulation Element indicates that Palomar Street between Interstate Route 5 and Orange Avenue be widened to six-lanes and classified as a six-lane major roadway. This improvement will increase available capacity and will improve this segment of Palomar Street level of service to acceptable levels. The Planning and Engineering firm of Project Design Consultants, has prepared a preliminary conceptual striping and roadway improvement plan for this widening, which was used in the analysis of effectiveness of this mitigation measure for both the roadway segments and intersections along the Palomar Street corridor. It is important to recognize that the roadway improvement project proposed by the project applicant and shown on the Project Design Consultants design sheet (dated 9-13-90) only includes the segment of Palomar Street between Orange Avenue and Industrial Boulevard. Thus, the westerly segment of Palomar Street between Industrial Boulevard and Interstate 5 must be monitored to ensure that the existing four lane cross section will be capable of handling the increased traffic flow in the future. As shown in the analysis of signalized intersections the critical intersections along this segment (Industrial Boulevard, I-5 Northbound ramps) are projected to operate at acceptable levels during the PM peak.

Figure 8-1 (page 8-9) illustrates the roadway segment mitigation measures recommended above. Table 8-1 summarizes roadway segment levels of service with proposed improvements.

Table 8-1

STREET CLASSIFICATIONS AND VOLUME-TO-CAPACITY RATIOS (V/C)
WITH PROJECT AND MITIGATION VS. WITHOUT MITIGATION
FUTURE YEAR 1992 CONDITIONS

Roadway Segment	Year 1992 ADT	Recommended Maximum Design Volume (1)	With Mitigation V/C (2)	Mitigation Without V/C (2)
Palomar St. - Class I Collector				
Bay Blvd. - I-5	6,600	22,000	0.30	0.30
I-5 - Industrial Blvd.	34,400	22,000	1.56	1.56
Palomar St.-Six Lane Major				
Industrial Blvd. - Broadway	35,900	40,000	0.90	1.20
Broadway - Orange Ave.	29,300	40,000	0.89	1.33
Palomar St. - Class I Collector				
Orange Ave. - Fifth Ave.	16,600	22,000	0.75	0.75
Anita St. - Class III Collector				
Industrial - Broadway	7,300	7,500	0.97	0.97
Broadway - Fifth Ave.	5,000	7,500	0.67	0.67
Main St. - Four-Lane Major				
Industrial Blvd. - Broadway	22,500	22,000	1.02	1.02
Industrial Blvd. - Class II Collector				
Naples St. - Palomar St.	5,400	12,000	0.45	0.45
Palomar St. - Anita St.	10,100	12,000	0.84	0.83

Table 8-1 (Continued)

STREET CLASSIFICATIONS AND VOLUME-TO-CAPACITY RATIOS (V/C) WITH PROJECT AND MITIGATION VS. WITHOUT MITIGATION FUTURE YEAR 1992 CONDITIONS

Roadway Segment	Year 1992 ADT	Recommended Maximum Design Volume (1)	With Mitigation V/C (2)	Without Mitigation V/C (2)
Broadway - Four-Lane Major				
Oxford St. - Palomar St.	23,800	30,000	0.79	0.79
Palomar St. - Anita St.	21,000	30,000	0.70	0.70
Anita St. - Main St.	18,600	30,000	0.62	0.62
Orange Ave. - Four-Lane Major				
Palomar St. - Fifth Ave.	10,600	30,000	0.35	0.35

Notes:

1. Currently the City of Chula Vista plans for LOS C conditions as a minimum for all Circulation Element facilities.
2. The v/c ratio is based on the capacity of the roadway segment at LOS C. Thus, it gives an indication of the roadway's carrying capacity in relation to the City's minimum standards. It is not indicative of the actual (functional) capacity of the roadway.

Source: Future Year 1992 ADT data was derived from Chula Vista Traffic Counts (Traffic Flow Report, November 12, 1990).

SIGNALIZED INTERSECTIONS

Intersections in the study area currently operate at acceptable levels of service. When the future growth in traffic and project traffic are added, however, three intersections are expected to experience poor levels of service.

The intersection of Palomar Street/Project Entrance is expected to have poor levels of service with project traffic added to Year 1992 conditions for the PM peak hour. JHK recommends the following geometric improvements to this intersection:

- Eastbound - the addition of one through lane.
- Westbound - the addition of one left-turn lane and one a through lane.

Although the intersection operation would improve to acceptable levels without the additional through lanes, it is necessary to accommodate the widening of Palomar Street discussed above. Also, it is recommended that a traffic signal be installed at this location to facilitate the volumes to be generated by this development.

The intersection of Palomar Street/Broadway is also expected to have poor levels of service under the Year 1992 with project condition during the PM peak hour. JHK recommends the following improvements to this intersection.

- Eastbound - the addition of one left turn lane
- Westbound - the addition of one through lane.

The intersection of Broadway and Main Street currently operates at LOS D during the PM peak hour. The poor level of service is expected to continue both with and without the proposed project. JHK & Associates does suggest some geometric improvements to this intersection including the following:

- Eastbound: the addition of one through lane.
- Westbound: the addition of one through lane.
- Southbound: construction of one left-turn lane.
- Northbound: construction of one left-turn lane.

With these improvements in place, the intersection would operate at acceptable levels of service.

Although the remaining intersections along Palomar Street (i.e., Palomar Street/Industrial Boulevard, and Palomar Street/Trolley Station) are expected to operate at acceptable levels of service under the Future Year 1992 with project condition without mitigation, additional through lanes on Palomar Street are shown to reflect the recommended widening of the Palomar Street corridor. Table 8-2 summarizes intersection ICU and LOS with mitigation measures in place.

Conformance with Threshold Standards

As shown on Table 8-2, all study area signalized intersections are projected to operate at LOS C or better. Thus full conformance with the adopted standards is achieved for the Future Year 1992 with project conditions with recommended mitigation measures in place.

Project Generated Traffic Contribution

The following table is based on Year 1992 PM peak hour intersection entering volumes with and without the project generated traffic added. This information is included to give an indication of impacts attributable to the project.

Intersection	PM Peak Period Without Project Entering Volume	PM Peak Period With Project Entering Volume	Project Contribution (%)
I-5 Southbound/ Palomar Street	1793	1928	7%
I-5 Northbound/ Palomar Street	2587	2887	13%
Industrial Boulevard/ Palomar Street	2959	3337	11%
Trolley Station Entrance/ Palomar Street	2807	3341	16%
Broadway/Palomar Street	3776	4301	12%
Orange Avenue/ Palomar Street	1754	1844	5%
Broadway/Anita Street	1887	2049	8%
Broadway/Main Street	3838	3928	2%
Industrial Boulevard/ Anita Street	922	978	6%

Table 8-2

INTERSECTION CAPACITY UTILIZATION (ICU)
AND LEVEL OF SERVICE (LOS)
FOR STUDY AREA SIGNALIZED INTERSECTIONS
PM PEAK HOUR
YEAR 1992
WITH PROJECT TRAFFIC AND MITIGATION

Intersection	With Mitigation		Without Mitigation	
	ICU	LOS	ICU	LOS
I-5 Southbound/Palomar St.	0.59	A	0.59	A
I-5 Northbound/Palomar St.	0.78	C	0.78	C
Industrial Blvd./Palomar St.	0.56	A	0.56	A
Trolley Station Entrance/Palomar St.	0.57	A	0.71	C
Project Entrance/Palomar St.	0.66	B	0.93	E
Broadway/Palomar St.	0.74	C	0.82	D
Orange Ave./Palomar	0.51	A	0.51	A
Broadway/Anita St.	0.64	B	0.64	B
Broadway/Main St.	0.74	C	0.87	D
Industrial Blvd./Anita St.	0.48	A	0.48	A

PARKING

The proposed project includes 911 parking spaces, or five spaces per 1,000 square feet. This is in accordance with City of Chula Vista Standard and requires no mitigation measures.

ACCESS AND INTERNAL CIRCULATION

In addition to the central driveway and the Palomar Trolley Station entrance, three other access points will be provided that are restricted to right-turns in and right-turns out, in conjunction with a raised median on Palomar Street, one access point will be located to the east of the site on Broadway with right and left turns in and right-turns out. Care must be taken when designing this left-turn pocket, as it is likely to be confused with the left-turn pocket from northbound Broadway to westbound Palomar Street.

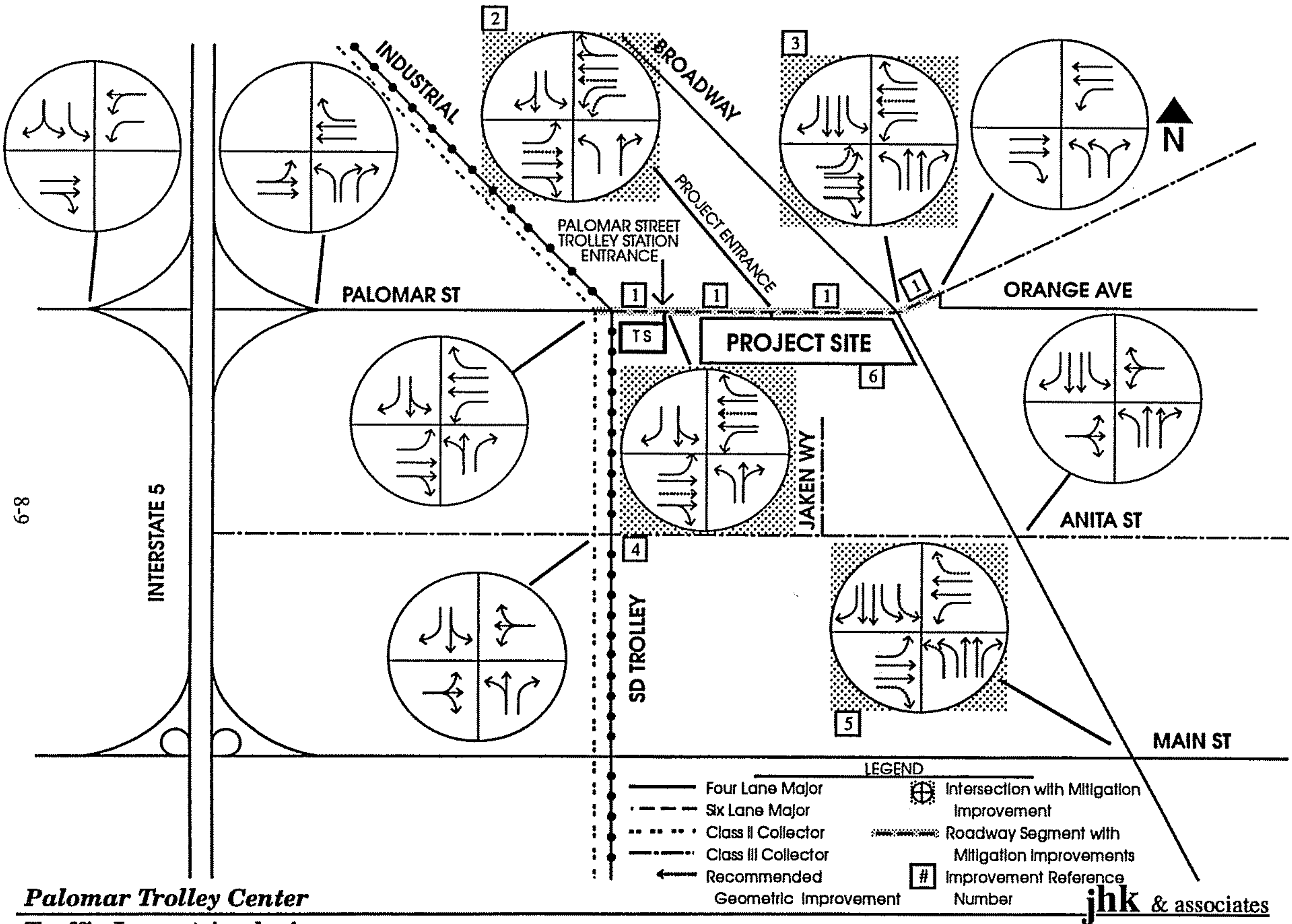
Internal circulation will be provided by an inner loop road around the shopping center connected by a series of parking aisles. The internal circulation and parking layout adjacent to each individual restaurant pads should be re-evaluated when specific plans are made for these uses on the proposed project site.

JHK & Associates recommends that a raised median be incorporated into the design of the main entrance driveway serving the Trolley Center site. This on-site raised median should be continuous for a distance of approximately 150 feet south of the signalized intersection at Palomar Street. This raised median will provide uninterrupted storage for northbound left turning vehicles and will also insure uniform traffic flow south of the signal in both directions.

It is strongly recommended that the proposed project provide an internal connection from its parking lot to the existing Trolley Station parking lot. This will provide vehicles leaving the Trolley Station an alternate exit at the signalized intersections at the proposed main project entry and reduce delay at the unsignalized Trolley Station exit if the Trolley Station traffic signal is relocated. In addition to this physical linkage for vehicles it is recommended that a similar linkage be provided exclusively for pedestrians.

SUMMARY OF MITIGATION REQUIREMENTS

The analysis conducted in this traffic study indicates the need for improvements to the circulation system adjacent to the site to mitigate the impacts of this project and the cumulative growth in traffic. The following list describes each improvement measure and the numbering scheme corresponds to the graphic display of the roadway and intersection mitigation measures shown in Figure 8-1.



Palomar Trolley Center

Traffic Impact Analysis

Figure 8-1

FUTURE GEOMETRICS AND ROAD CLASSIFICATIONS WITH MITIGATION
YEAR 1992

Roadway Segments

1. Widen Palomar Street between Industrial Boulevard and Orange Avenue to provide a six-lane major street to the satisfaction of the City Engineer.

Intersections

2. Install a traffic signal at the proposed intersection of Palomar Street/Project Entrance and construct the following lane geometrics:

    - Eastbound - one left, two through, and one through/right
    - Westbound - two left, two through, and one through/right
    - Northbound - one left, and one through/right
    - Southbound - one left, and one through/right

3. Improve the intersection of Palomar Street/Broadway to provide the following lane geometrics:

    - Widen the eastbound approach to provide an additional left turn lane and widen the westbound approach to provide an additional through lane. The resulting geometric configuration for this intersection is detailed below:

    - Eastbound - two left, two through and one through/right
    - Westbound - one left, three through, and one right
    - Northbound - one left, two through, and one right
    - Southbound - one left, two through, and one right

4. Improve the intersection of Palomar Street/Trolley Station Entrance to provide the following lane geometrics:

    - Widen the eastbound and westbound approaches to provide an additional through lane in each direction. The resulting geometric configuration for this intersection is detailed below:

    - Eastbound - one left, two through, and one through/right
    - Westbound - one left, three through, and one right
    - Northbound - one left, and one through/right
    - Southbound - one left/through, and one right

5. Improve the intersection of Main Street/Broadway to provide the following lane geometrics:

- Widen the eastbound and westbound approaches to provide an additional right turn lane in each direction and widen the northbound and southbound to provide an additional left turn lane in each direction. The resulting geometric configuration for this intersection is detailed below:

  - Eastbound - one left, two through, and one through/right
  - Westbound - one left, two through, and one right
  - Northbound - two left, two through, and one right
  - Southbound - two left, two through, and one right

Site Access and Internal Circulation

6. The following mitigation strategies and site improvements should be required by the City during the review of the site design plans:

   - It is recommended that a raised median be incorporated into the design of the Main Entrance driveway serving the Trolley Center site. This on-site raised median should be continuous for a distance of approximately 150 feet south of the signalized intersection at Palomar Street. This raised median will provide uninterrupted storage for northbound left turning vehicles and will also insure uniform traffic flow south of the signal in both directions.

   - In addition to the Main Entrance Driveway and the Palomar Trolley Station Entrance, three other access points will be provided restrict access at these locations to right-turns in and right-turns out, in conjunction with a raised median on Palomar Street.

   - The access point located to the east of the site on Broadway shall be restricted to with right and left turns in a right-turns out. Care must be taken when designing this left-turn pocket, as it is likely to be confused with the left-turn pocket from northbound Broadway to westbound Palomar Street.

   - The internal circulation and parking layout adjacent to each individual restaurant pad should be re-evaluated when specific plans are made for these uses on the proposed project site.

   - It is strongly recommended that the proposed project provide an internal connection from its parking lot to the existing Trolley Station parking lot. This will provide vehicles leaving the Trolley Station an alternate exit at the signalized intersections at the proposed main project entry and reduce delay at the unsignalized Trolley Station exit if the Trolley Station traffic signal is relocated. In addition to this physical linkage for vehicles it is recommended that a similar linkage be provided exclusively for pedestrians.

CONCLUSIONS

The improvements described in the previous section will mitigate the traffic impact of the Proposed Palomar Trolley Center. Roadway capacities will be sufficient to serve the new site generated traffic as well as traffic generated by existing uses and approved projects in the area.

9. ADDITIONAL TRAFFIC ENGINEERING ANALYSES

INTRODUCTION

Over the course of the development of this study, JHK was asked to provide additional traffic engineering information beyond the original scope of work. These additional tasks included the following analyses:

- Delay studies of critical study area intersections using the 1985 Highway Capacity Manual (HCM) recommended methodologies.
- Signal timing progression analysis to test the impact of the addition of a mid-block signal at the proposed project entrance. Also, this task included the review of the impacts associated with relocating the existing signal at the Palomar Street Trolley Station intersection further to the east to serve the new Trolley Center Development.
- Analysis of existing and future arterial levels of service utilizing the metnod described in Chapter 11, "Urban and Suburban Arterials" of the 1985 Highway Capacity Manual.

The results of these additional technical analyses are included in this chapter, and the worksheets are included in Appendix E and F of this report.

PURPOSE

The purpose of these analyses resulted from the City of Chula Vista Engineering Division's concern regarding the potential negative impact of installing a new traffic signal at the Project Main Entrance/Palomar Street intersection. Thus, this additional analysis is intended to determine the feasibility of installing this new signal in the existing Palomar Street signal system. The analysis also documents the impacts to arterial performance under a variety of system configurations.

OVERVIEW

The critical study area intersections in this study are those along Palomar Street between Industrial Boulevard and Orange Avenue, as these intersections will be impacted to the highest degree by project generated traffic. Also east-west progression along Palomar Street is currently impacted and will be impacted in the future by the trolley operations. It is for this reason that the following Palomar Street intersections were selected for inclusion in this additional series of analyses:

- Palomar Street/Industrial Boulevard
- Palomar Street/Trolley Station
- Palomar Street/Project Main Entrance
- Palomar Street/Broadway
- Palomar Street/Orange Avenue

The following series of analyses were conducted using the projected Year 1992 traffic volumes for both with and without the project. As discussed in Chapter 6, the City of Chula Vista General Plan Circulation Element forecasted volumes for buildout of the street network in the project vicinity indicate future volume will stabilize at today's levels or decrease. Therefore, this future Year 1992 with project condition is considered to be the worst case analysis.

HIGHWAY CAPACITY MANUAL (HCM) DELAY STUDY

Purpose

The purpose of this analysis is to confirm the level of service findings included in Chapters 3, 4, 6, and 7 of this report. For these chapters, JHK utilized the Intersection Capacity Utilization (ICU) analysis method for all study area intersections. However, due to the critical nature of the intersections along the Palomar Street corridor listed above, which are heavily impacted by trolley operations, the City of Chula Vista directed JHK to further analyze these intersections to confirm the ICU levels of service using the 1985 Highway Capacity Manual. The purpose of the following analysis is to confirm that the predicted levels of service are within a reasonable range of agreement between the two methodologies, especially for predicting future LOS conditions.

Methodology

The levels of service at the critical study area intersections were determined using the "Operational Method" outlined in Chapter 9 of the 1985 HCM for signalized intersections. Levels of service for signalized intersections, using this methodology, are defined in terms of average delay per vehicle in seconds. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. The level of service criteria for signalized intersections is shown on Table 9-1. Levels of service A through C are considered acceptable in all conditions, and level of Service D is also considered acceptable in densely developed urban study areas, such as the Palomar Trolley Center Study area. Levels of service E and F are considered unacceptable; and, if possible, mitigation measures should be implemented to allow LOS A through D conditions to prevail under future conditions.

Table 9-1

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS
HCM METHOD

Level of Service	Average Delay (Seconds per Vehicle)
A	<=5.0
B	5.1 - 15.0
C	15.1 - 25.0
D	25.1 - 40.0
E	40.1 - 60.0
F	60.0 or more

Source: HCM, Chapter 9, "Signalized Intersections."

Table 9-2 shows the results of the HCM analysis as compared to the ICU analysis method. As can be seen, the HCM methodology predicted similar levels of service as the ICU analysis method. For most locations, the HCM method predicted the same LOS as the ICU method or one level worse. Exceptions are under the Existing Year 1990 and Future Year 1992 (without Project) conditions at the Palomar Street/Orange Avenue intersection, and under Future Year 1992 (with Project) conditions the HCM method once again predicts poorer level of service by two full LOS ranges. This is due to the unique configuration of this intersection and the fact that high turn volumes are predicted to continue to occur at this location. The HCM method of analysis is more sensitive to these conditions and thus predicts a more conservative LOS for future Year 1992 conditions.

However, the most important information that can be gained by this analysis is that under the Year 1992 with the Project and with mitigation, both the HCM and the ICU methods predict acceptable levels of service for the critical study area intersections. The worksheets from the HCM analysis are included in Appendix E of this report.

SIGNAL TIMING PROGRESSION ANALYSIS

During the development of the final scope of work for this study, the City of Chula Vista Traffic Engineering Department requested that a signal timing progression analysis be performed for the following signal placement alternatives under Future Year 1992 conditions with and without the project:

Alternative No. 1 - Retain the existing signal at the trolley station and do not add any new traffic signals.

Alternative No. 1A - Year 1992 conditions without project.

Alternative No. 1B - Year 1992 condition with project.

Alternative No. 2 - Relocate the existing trolley station signal approximately 200 feet to the east. In addition, a left turn only non-signalized access could be provided further along Palomar Street.

Alternative No 3 - Relocate the existing trolley station signal midblock.

Alternative No. 4 (Proposed Alternative) - Retain the existing signal at the trolley station. Add a new midblock signal.

Figure 9-1 graphically illustrates JHK's interpretation of these alternatives. For this analysis, JHK utilized the PASSER II-87 software package to determine the optimal signalization scheme for the Palomar Street arterial within the study area under each of the alternatives shown in Figure 9-1 and described above.

Table 9-2

PM Peak Hour Conditions
USING ICU AND HCM METHODS
Year 1990. 1992

Existing Year 1990

	ICU Method		HCM Method	
Intersection	ICU	LOS	Delay	LOS
Palomar St/Industrial Blvd	0.60	B	9.3	B
Palomar St/Trolley Station	0.55	A	8.1	B
Palomar St/Broadway	0.68	B	22.6	C
Palomar St/Orange Ave	0.47	A	20.4	C

Future Year 1992 - Without Project

	ICU Method		HCM Method	
Intersection	ICU	LOS	Delay	LOS
Palomar St/Industrial Blvd	0.63	B	10.6	B
Palomar St/Trolley Station	0.58	A	8.4	B
Palomar St/Broadway	0.69	B	23.7	C
Palomar St/Orange Ave	0.49	A	20.9	C

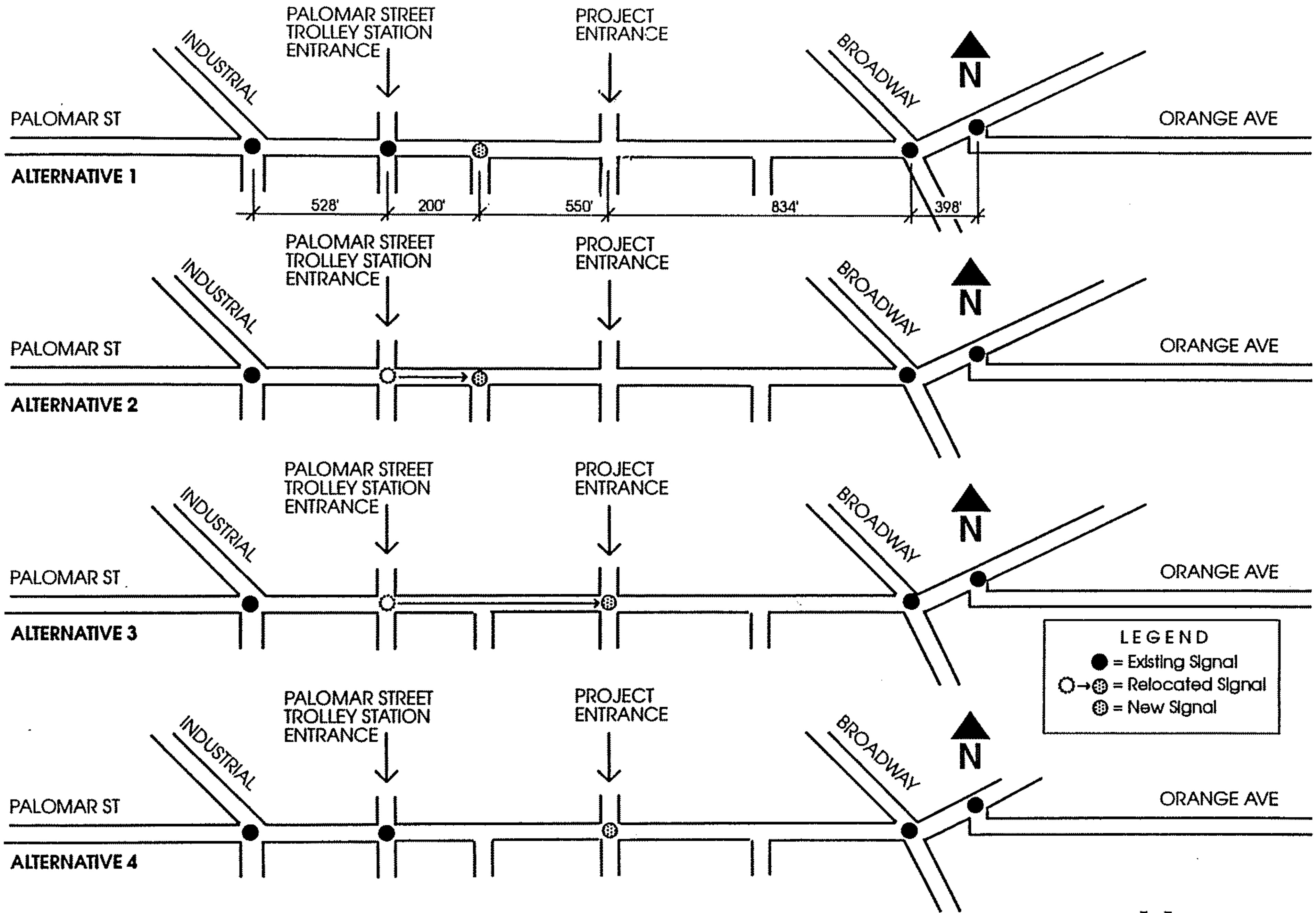
Future Year 1992 - With Project

	ICU Method		HCM Method	
Intersection	ICU	LOS	Delay	LOS
Palomar St/Industrial Blvd	0.68	B	16.8	C
Palomar St/Trolley Station	0.70	C	9.5	B
Palomar St/Project Entrance	0.93	E	59.5	E
Palomar St/Broadway	0.82	D	25.5	D
Palomar St/Orange Ave	0.51	A	21.9	C

Future Year 1992 - With Project and Mitigation

	ICU Method		HCM Method	
Intersection	ICU	LOS	Delay	LOS
Palomar St/Industrial Blvd	0.54	A	7.4	B
Palomar St/Trolley Station	0.57	A	7.6	B
Palomar St/Project Entrance	0.66	B	23.0	C
Palomar St/Broadway	0.70	C	23.2	C

Note: Delay is defined as average delay in seconds per vehicle



Palomar Trolley Center

Traffic Impact Analysis

jhk & associates

Figure 9-1

ARTERIAL SIGNAL PLACEMENT ALTERNATIVES

Methodology

PASSER II-87, an acronym for the Progression Analysis and Signal System Evaluation Routine, was developed by the Texas Transportation Institute. The software package provides signal timing reports for both under- and over-saturated arterial traffic operations. The program allows for various methods of left-turn analysis and advanced capacity evaluation. PASSER II-87 can assist in analyzing isolated intersection timing evaluations, progression signal timing optimization, and existing timing evaluations. For this analysis, PASSER II-87 was used to determine the optimal signal timing for the best progression and minimum delay that could be implemented on the Palomar Street signal system under each of the alternative signal configurations shown on Figure 9-1.

Findings

Appendix F contains the PASSER II-87 analysis results. The following Tables 9-3 through 9-7 present summaries of the PASSER II-87 results.

- Alternative 4, has relatively poor progression (Efficiency = 0.14) and a small amount of average intersection delay (12.8 sec/veh). Total system delay is high (63.1 veh-hr/hr) compared with Alternative 2 (50.7 veh-hr/hr).
- The difference between the future without project condition and the future with project condition is fairly substantial. Under these two alternatives average delay ranges from 11.7 to 20.9 seconds per vehicle, total delay ranges from 40.3 to 83.3 vehicle hours per hour, and efficiency ranges from 0.30 to 0.22.
- Aside from the future without project condition, Alternative 2 attained the best efficiency, average delay, and total delay, mainly due to the fact that it proposes a signalized intersection at the minor entrance and no signal for either the main entrance or the Trolley Station Entrance. From a signal operations perspective, this is the best alternative; however, not locating signals at major ingress/egress points to existing and proposed developments is a significant consideration. Alternative 2 thus does not match existing or proposed access requirements along Palomar Street.

ANALYSIS OF EXISTING AND FUTURE ARTERIAL LEVELS OF SERVICE

This analysis provides an indication of existing and future levels of service along the Palomar street facility by direction (east-west). The arterial levels of service are based on the average travel speed for the segment, section, or entire arterial under consideration. For this analysis, the section of Palomar Street between Industrial Boulevard and Orange Avenue was considered. The average travel speed of all through vehicles is computed from the running time on the arterial segments and the intersection approach delay. Average travel speed is influenced by the number of signals and the average intersection delay. Table 9-8 illustrates the criteria for judging arterial level of service.

Table 9-4

PASSER II-87 RESULTS
ALTERNATIVE 1(B)
FUTURE YEAR 1992 WITH PROJECT

Intersection	Delay	V/C	LOS
Palomar St/Industrial Blvd	10.6	0.81	B
Palomar St/Trolley Station	22.6	0.99	C
Palomar St/Broadway	32.9	0.97	D
Palomar St/Orange Ave	7.5	0.54	B

Band Width= EB = 23 secs.
WB = 18 secs.
Average Progression Speed = 38 mph
Progression Efficiency= 0.22
Average Intersection Delay = 20.9 sec./veh.
Total System Delay = 83.3 veh-hr/hr

Note: Future delays as calculated by PASSER II-87 software. May not agree with calculations of individual intersection level of service by the Highway Capacity Software documented in Appendix E.

Table 9-5

PASSER II-87 RESULTS
ALTERNATIVE 2
FUTURE YEAR 1992 WITH PROJECT

Intersection	Delay	V/C	LOS
Palomar St/Industrial Blvd	6.4	0.66	B
Palomar St/Minor Project Entrance	9.5	0.72	B
Palomar St/Broadway	20.3	0.98	C
Palomar St/Orange Ave	5.3	0.56	B

Band Width= EB = 17 secs.
WB = 18 secs.
Average Progression Speed = 40 mph
Progression Efficiency= 0.28
Average Intersection Delay = 12.6 sec./veh.
Total System Delay = 50.7 veh-hr/hr

Note: Future delays as calculated by PASSER II-87 software. May not agree with calculations of individual intersection level of service by the Highway Capacity Software as documented in Appendix E.

Table 9-6

PASSER II-87 RESULTS
ALTERNATIVE 3
FUTURE YEAR 1992 WITH PROJECT

Intersection	Delay	V/C	LOS
Palomar St/Industrial Blvd	8.2	0.65	B
Palomar St/Main Project Entrance	22.7	0.81	C
Palomar St/Broadway	19.4	0.87	C
Palomar St/Orange Ave	5.7	0.56	B

Band Width= EB = 12 secs.
WB = 9 secs.
Average Progression Speed = 42 mph
Progression Efficiency= 0.14
Average Intersection Delay = 15.8 sec./veh.
Total System Delay = 64.1 veh-hr/hr

Note: Future delays as calculated by PASSER II-87 software. May not agree with calculations of individual intersection level of service by the Highway Capacity Software as documented in Appendix E.

Table 9-7

PASSER II-87 RESULTS
ALTERNATIVE 4
FUTURE YEAR 1992 WITH PROJECT

Intersection	Delay	V/C	LOS
Palomar St/Industrial Blvd	6.9	0.66	B
Palomar St/Trolley Station	10.9	0.66	B
Palomar St/Main Projec t Entrance	16.6	0.64	C
Palomar St/Broadway	18.7	0.88	C
Palomar St/Orange Ave	5.6	0.56	B

Band Width= EB = 11 secs.
WB = 9 secs.
Average Progression Speed = 38 mph
Progression Efficiency= 0.14
Average Intersection Delay = 12.8 sec./veh.
Total System Delay = 63.1 veh-hr/hr

Note: Future delays as calculated by PASSER II-87 software. May not agree with calculations of individual intersection level of service by the Highway Capacity Software as documented in Appendix E.

Table 9-8

LEVEL OF SERVICE CRITIERIA FOR ARTERIALS HCM METHOD

Arterial Class	I	II	III
Range of Free Flow Speeds (mph)	45 to 35	35 to 30	35 to 25
Typical Free Flow Speed (mph)	40 mph	33 mph	27 mph
Level of Service	**Average Travel Speed (mph)**		
A	>=35	>=30	>=25
B	>=28	>=24	>=19
D	>=17	>=14	>=9
E	>=13	>=10	>=7
F	<13	<10	>=7

Source: HCM, Chapter 11, "Urban and Suburban Arterials."

For the analysis of the Palomar Street facility, Palomar Street was assumed to be a Class I arterial. Table 9-9 summarizes the arterial levels of service for both eastbound and westbound for the existing Year 1990 and Future Year 1992 condition with and without the project and mitigation.

SUMMARY OF ALTERNATIVE EVALUATION

As shown on Summary Table 9-10, each alternative configuration of the future signal system on Palomar Street results in different levels of performance for the overall signal system. The following conclusions can be drawn from the information provided on this table and the background information provided in the technical research documented in this chapter.

MINIMAL PROJECT OBJECTIVES

The four alternative signalization scenarios were evaluated in terms of measures of performance and the extent to which they met the following minimal project objectives:

- To maintain high quality traffic flow and arterial performance on the major circulation element facility of Palomar Street.
- To provide high quality service for bus movements into and out of the existing Trolley Station.
- To provide high quality and safe access to and from the existing commercial development center to the north of Palomar Street adjacent to the project site.
- To provide high quality and safe access to and from the new proposed Trolley Center development project.

COMPARISON OF ALTERNATIVES

The four alternatives were evaluated based upon four criteria in an engineering matrix analysis worksheet. The following four criteria were included:

- Progression Efficiency - Does the alternative provide for the greatest percentage of vehicles to pass through the Palomar Street Arterial System without stopping?
- Average Intersection Delay - Does the alternative provide the least amount of average delay per intersection along Palomar Street?
- Total System Delay - Does the alternative provide the least delay along the entire system, in terms of vehicle hours per hour?
- Arterial Level of Service - Does the alternative provide the highest average travel speed through the area?

Table 9-9

PM PEAK HOUR CONDITIONS
ARTERIAL LEVEL OF SERVICE
HCM METHOD

Measures of Performance

	Eastbound		Westbound	
Condition	**ATS**	**LOS**	**ATS**	**LOS**
Existing Year 1990	17.7 mph	D	15.5 mph	E
Future Year 1992 - Alternative 1(A)	24.8	C	23.5	C
Future Year 1992 - Alternative 1(B)	15.3	E	16.8	E
Future Year 1992 - Alternative 2	20.7	D	22.2	C
Future Year 1992 - Alternative 3	18.1	E	17.5	D
Future Year 1992 - Alternative 4	17.4	D	17.6	D

Note: ATS= Arterial Travel Speed

Table 9-10

SUMMARY OF ARTERIAL PERFORMANCE
FUTURE YEAR 1992 CONDITIONS

	Measures of Performance						
	Progress.	Average	Total	Eastbound		Westbound	
Condition	Efficiency	Int. Delay	Sys. Delay	ATS	LOS	ATS	LOS
Existing Year 1990	N/A	N/A	N/A	17.7 mph	D	15.5 mph	E
Future Year 1992 - Alternative 1(A)	0.30	11.7	40.3	24.8	C	23.5	C
Future Year 1992 - Alternative 1(B)	0.22	20.9	83.3	15.3	E	16.8	E
Future Year 1992 - Alternative 2	0.28	12.6	50.7	20.7	D	22.2	C
Future Year 1992 - Alternative 3	0.14	15.8	64.1	18.1	D	17.5	D
Future Year 1992 - Alternative 4	0.14	12.8	63.1	17.4	D	17.6	D

Note: ATS = Average Travel Speed

Each of the four alternatives were evaluated, and ranked on a scale of I-5 using of the four traffic engineering criteria described above. A grade of one represents the least desirable impact (lowest ranking) and five presents the most desirable impact (highest ranking). This engineering matrix analysis worksheet is illustrated in Table 9-11. On the far right side of Table 9-11, the total score for each alternative is shown. This total score is the sum of the individual scores for each of the four evaluation criteria included in the analysis. These scores and the entire evaluation process were established by JHK in coordination with the City of Chula Vista.

ALTERNATIVE EVALUATION RESULTS

Alternative 2 has the highest performance rating under Future Conditions with project traffic. However, Alternative 2 does not achieve the minimal project objectives. Alternative No. 2 would require the redesign of the internal circulation pattern and site layout for the proposed Trolley Center development project, since the main entrance would be shifted to the west of the proposed main entrance. Also, this on-site circulation system would have to be modified to provide a high quality linkage to the existing Trolley Station for internal bus circulation, which would need to be of an uninterrupted type flow on-site. The access pattern for the existing commercial development project to the north would have to be modified. The combination of these effects discount the high rating of this alternative.

The alternative that ranked with the second highest score was Alternative No. 4. As shown on Figure 9-1, Alternative No.4 places a new signalized intersection at the approximate midpoint between the two existing signals at the Palomar Trolley Station/Palomar Street and Broadway/Palomar Street. This intersection as analyzed in this traffic analysis report, is warranted under future volume conditions with project traffic (see Chapter 6). It can also be concluded from this additional future engineering analysis that this alternative achieves all three goals that were documented previously including the following:

- Alternative 4 does provide high quality service for bus movements into and out of the existing Trolley Station.
- Alternative 4 does provide high quality and safe access to and from the existing commercial development center to the north of Palomar Street adjacent to the project site.
- Alternative 4 does provide high quality and safe access to and from the new proposed Trolley Center development project.

Even with achievement of these goals, the concerns that the City Traffic Engineering Division has regarding the potential negative impacts of installing the new traffic signal at the project main entrance have been fully analyzed. Thus, based on the conclusions of this technical

Table 9-11

ENGINEERING MATRIX ANALYSIS WORKSHEET
PALOMAR STREET SIGNAL PLACEMENT ALTERNATIVES

Condition	Progress. Efficiency	Average Int. Delay	Total Sys. Delay	Average Travel Speed	Total Score
Future Year 1992 - Alternative 1(A)	5	4	5	4	18
Future Year 1992 - Alternative 1(B)	3	3	1	1	8
Future Year 1992 - Alternative 2	4	4	4	3	15
Future Year 1992 - Alternative 3	1	3	3	2	12
Future Year 1992 - Alternative 4	1	4	3	2	14

analysis, it is determined that the installation of a signal at this location can occur with a minimal amount of impact to future traffic flow along Palomar Street. Further more, with proper signal timing plans implemented along the Palomar Street arterial signed system, high quality traffic flow characteristics and levels of service can be achieved.

10. FINDINGS

As a result of the technical analysis conducted for the proposed Trolley Center Development Project a number of findings and conclusions have been reached. The following list identifies the most significant findings of the analysis. Each finding is also accompanied by a presentation of a technical discussion supporting the development of the finding.

PROJECT SITE SIGNAL

- Based on the total trip generation potential for this development of 13,874 trips, it will be necessary to provide a new traffic signal on Palomar Street to serve the project site at it's Main Entrance Driveway.

    - The existing Trolley Station traffic signal must be retained at it's current location to provide safe and efficient operations for existing and future bus access to the station.

    - The optional location for the new Palomar Trolley Center traffic signal is at an appropriate mid-point between the Trolley Station signal and the Broadway signal on Palomar Street. The Main Entrance to the site should align with the existing driveway to the development on the north side of Palomar Street.

    - Acceptable arterial performance can be achieved on Palomar Street with new traffic signal in place assuming proper signal timing plans are developed for the Palomar Street facility between Interstate 5 and Orange Avenue.

PROJECT SITE ACCESS

- The provision of an alternate vehicular accesses to the site via Token Way would not significantly reduce off-site impacts, or alter study area roadway segment or intersections levels of service.

PALOMAR STREET CAPACITY

- Based on the cumulative growth in traffic along Palomar Street west of Broadway and the new traffic generated by the proposed development six-loads of capacity will require on Palomar Street between Broadway and Industrial Boulevard.

- The segment of Palomar Street between Industrial Boulevard and Interstate 5 must be monitored by the City Traffic engineering Division in the future, and the City Traffic Engineer will determine if roadway widening is also required on this segment. This due to the fact that acceptable levels of service are projected at the signalized intersections on Palomar Street at Industrial Boulevard and the Interstate 5 ramps in the future.

OFF-SITE INTERSECTION CAPACITY

- All of the intersection mitigation measures recommended in Chapter 8 must be implemented prior to construction of the proposed Palomar Trolley Center development project.

APPENDIX A

ICU CALCULATION WORKSHEETS
EXISTING YEAR 1990
PM PEAK HOUR

INTERSECTION CAPACITY UTILIZATION MODEL

```
   NS : I-5 SB                         EXISTING
   EW : Palomar Road                   PM PEAK
```

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                   170     0   470
                    |      |    |
                  <--'     v    `-->
           ^        0.5    0   1.5        ^
   0 ----'    0                       0  `----   0
 310 -----> 2                        1 <-----  100
 140 ----,  0                        1  ,----  500

           v                              v
                     0      0     0
                  <--,      ^     ,-->
                    |       |     |        ^
                    0       0     0        |
                                         North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	0	0	0
Southbound	2250	0	750
Eastbound	0	3400	0
Westbound	0	3000	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	0.0%	0.0%	0.0%
Southbound	20.9%	0.0%	22.7%
Eastbound	0.0%	13.2%	0.0%
Westbound	0.0%	20.0%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 52.7%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

NS : I-5 NB   EXISTING
EW : Palomar Road   PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                      0     0     0
                      :     :     :
                 <--'       v     `-->
           ^          0     0     0        ^
  50 ----'    0                        1  `----  560
 730 ----->   2                        2 <-----  548
   0 ----,    0                        0  ,----    0

           v                               v
                      1     0     2
                 <--,       ^     ,-->
                      :     :     :        ^
                     50     0   530        :
                                         North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	0	2700
Southbound	0	0	0
Eastbound	0	3200	0
Westbound	0	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	3.3%	0.0%	19.6%
Southbound	0.0%	0.0%	0.0%
Eastbound	0.0%	24.4%	0.0%
Westbound	0.0%	16.1%	37.3%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 67.0%

LEVEL OF SERVICE ----> B

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Industrial Avenue EXISTING
EW : Palomar Road PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                     51   110    16
                      |    |     |
                   <--'    v     '-->
          ^           1    1     0        ^
    63 ----'   1                      1   '----   64
  1142 ----->  2                      2  <-----  987
    63 ----.   0                      1   ,----   21

          v                               v
                      0    1     1
                   <--,    ^    ,-->
                      |    |    |         ^
                     114   89   75        |
                                        North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	0	1500	1500
Southbound	0	1500	1500
Eastbound	1500	3400	0
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	0.0%	13.5%	5.0%
Southbound	0.0%	8.4%	3.4%
Eastbound	4.2%	35.4%	0.0%
Westbound	1.4%	29.0%	4.3%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 60.4%

LEVEL OF SERVICE ----> B

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Trolley Station — EXISTING
EW : Palomar Road — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                  89     3     9
                   :     :     :
                 <--'    v     `-->
          ^        0     1     1       ^
  89 ----'    1                     1  `----   23
1163 ----->   2                     2 <----- 1108
  26 ----,    1                     1  ,----   47

          v                            v
                   1     1     0
                 <--,    ^     ,-->
                   :     :     :        ^
                  22     4    72        :
                                      North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	1700	0
Southbound	1500	1700	0
Eastbound	1500	3400	1500
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	1.5%	4.5%	0.0%
Southbound	0.6%	5.4%	0.0%
Eastbound	5.9%	34.2%	1.7%
Westbound	3.1%	32.6%	1.5%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 55.4%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

```
    NS : Broadway                        EXISTING
    EW : Palomar Road                    PM PEAK
```

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                       248   709   225
                        :     :     :
                      <--'    v     '-->
                ^       1     2     1       ^
     188 ----'   1                     1  `----  158
     723 -----> 3                     2 <-----  515
      89 ----,   0                     1  ,----  119

                v                           v
                        1     2     1
                      <--,    ^     ,-->
                        :     :     :       ^
                       106   311   170      :
                                          North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	1500	5100	0
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	7.1%	9.1%	11.3%
Southbound	15.0%	20.9%	16.5%
Eastbound	12.5%	15.9%	0.0%
Westbound	7.9%	15.1%	10.5%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 65.6%

LEVEL OF SERVICE ----> B

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Orange Avenue — Existing Year 1990
EW : Palomar Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                     0     0     0
                     |     |     |
                  <--'     v     '-->
          ^          0     1     0       ^
   0 -----'   0                    0  '-----    0
 576 ----->   2                    2  <-----  407
 384 -----,   1                    1  ,-----   13

          v                              v
                   1.5     0   0.5
                  <--,     ^     ,-->
                     |     |     |        ^
                   249     0     3        |
                                        North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	2250	0	750
Southbound	0	1500	0
Eastbound	0	3400	1500
Westbound	1500	3400	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	11.1%	0.0%	0.4%
Southbound	0.0%	0.0%	0.0%
Eastbound	0.0%	16.9%	25.6%
Westbound	0.9%	12.0%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 46.7%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway — EXISTING
EW : Anita Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                   64    588    66
                    !     !     !
                 <--'     v     '-->
         ^          0     2     1       ^
125 ----'   0                        0  '----   21
187 ----->  1                        1 <-----   94
 82 ----.   0                        0  .----   58

         v                              v
                    1     2     0
                 <--.     ^     .-->
                    !     !     !       ^
                   30    416    47      !
                                      North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	0
Southbound	1500	3400	0
Eastbound	0	1500	0
Westbound	0	1500	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	2.0%	13.6%	0.0%
Southbound	4.4%	19.2%	0.0%
Eastbound	0.0%	26.3%	0.0%
Westbound	0.0%	11.5%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 57.4%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway — EXISTING
EW : Main — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                   95   508   213
                    |    |     |
                 <--'    v     '-->
         ^          1    2     1         ^
122 ----'   1                      0  '---- 178
728 -----)  2                      2 (----- 826
145 ----,   0                      1  ,---- 209

         v                               v
                    1    2     1
                 <--,    ^     ,-->
                    |    |     |         ^
                   274  496   172        |
                                       North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	1500	3400	0
Westbound	1500	3400	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	18.3%	14.6%	11.5%
Southbound	14.2%	14.9%	6.3%
Eastbound	8.1%	25.7%	0.0%
Westbound	13.9%	29.5%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 82.8%

LEVEL OF SERVICE ----) D

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Industrial Blvd. Existing
EW : Anita Street PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                     16     80     83
                      !      .      !
                   <--'      v      `-->
              ^       1      1      0        ^
  133 ----'   0                          0  `----   16
  140 ----->  1                          1  <-----  47
   74 ----,   0                          0  ,----   71

              v                              v
                      0      1      1
                   <--,      ^      ,-->
                      !      !      !        ^
                     19     124    10        !
                                           North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	0	1500	1500
Southbound	0	1500	1500
Eastbound	0	1500	0
Westbound	0	1500	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	0.0%	9.5%	0.7%
Southbound	0.0%	10.9%	1.1%
Eastbound	0.0%	23.1%	0.0%
Westbound	0.0%	8.9%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 44.0%

LEVEL OF SERVICE ----> A

JHK &
Associates

APPENDIX B

ICU CALCULATION WORKSHEETS
FUTURE YEAR 1992 - WITHOUT PROJECT
PM PEAK HOUR

INTERSECTION CAPACITY UTILIZATION MODEL

NS : I-5 SB RAMP   Year 1992 w/o Project
EW : Palomar Street   PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                  180    0   499
                   |     |    |
                <--'     v    `-->
           ^      0.5    0   1.5      ^
   0 ----'   0                    0  `----   0
 329 ----->  2                    1 <-----  106
 149 ----,   0                    1  ,----  530

           v                              v
                   0     0     0
                <--,     ^    ,-->
                   |     |    |       ^
                   0     0    0       |
                                    North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	0	0	0
Southbound	2250	0	750
Eastbound	0	3400	0
Westbound	0	3000	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	0.0%	0.0%	0.0%
Southbound	22.2%	0.0%	24.0%
Eastbound	0.0%	14.1%	0.0%
Westbound	0.0%	21.2%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 55.2%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

NS : I-5 NB RAMP — Year 1992 w/o Project
EW : Palomar Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                 0     0     0
                 :     :     :
              <--'     v     `-->
         ^       0     0     0       ^
  53 ----'   0                 1  `----  594
 774 ----->  2                 2 <-----  581
   0 ----,   0                 0  ,----    0

         v                           v
                 1     0     2
              <--,     ^     ,-->
                 :     :     :       ^
                53     0   562       :
                                   North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	0	2700
Southbound	0	0	0
Eastbound	0	3200	0
Westbound	0	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	3.5%	0.0%	20.8%
Southbound	0.0%	0.0%	0.0%
Eastbound	0.0%	25.8%	0.0%
Westbound	0.0%	17.1%	39.6%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 70.4%

LEVEL OF SERVICE ----> C

INTERSECTION CAPACITY UTILIZATION MODEL

```
NS : Industrial Blvd            Year 1992 w/o Project
EW : Palomar Street             PM PEAK
```

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                    53   117   16
                     :    :     :
                  <--     v     -->
          ^          1    1     0        ^
  64 ----'   1                       1  '----   68
1212 -----   2                       2 <----- 1047
  67 ----,   0                       1  ,----   22

          v                              v
                     0    1     1
                  <--,    ^     ,-->
                     '    :     :        ^
                    121   92    77       :
                                       North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	0	1500	1500
Southbound	0	1500	1500
Eastbound	1500	3400	0
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	0.0%	14.2%	5.1%
Southbound	0.0%	8.9%	3.5%
Eastbound	4.3%	37.6%	0.0%
Westbound	1.5%	30.8%	4.5%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 63.7%

LEVEL OF SERVICE ----> B

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Trolley Station   Year 1992 w/o Project
EW : Palomar Street   PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                      92    3    10
                       |    |    |
                    <--'    v    '-->
           ^           0    1    1         ^
   92 ----'   1                        1  '----  24
 1234 -----> 2                        2 <----- 1175
   28 ----,   1                        1  ,----  48

           v                               v
                       1    1    0
                    <--,    ^    ,-->
                       |    |    |         ^
                      23    4    74        |
                                         North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	1700	0
Southbound	1500	1700	0
Eastbound	1500	3400	1500
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	1.5%	4.6%	0.0%
Southbound	0.7%	5.6%	0.0%
Eastbound	6.1%	36.3%	1.9%
Westbound	3.2%	34.6%	1.6%

EFFICIENCY LOST FACTOR   0.1

CAPACITY UTILIZATION

Percent Utilization   57.8%

LEVEL OF SERVICE   ---->   A

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway — Year 1992 w/o Project
EW : Palomar Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                 263   752   239
                  |     |     |
               <--'     v     `-->
         ^        1     2     1      ^
199 ----'   1                     1  `----  158
757 ----->  3                     2 <-----  546
 94 ----,   0                     1  ,----  126

         v                           v
                  1     2     1
               <--,     ^     ,-->
                  |     |     |       ^
                 112   330   180      |
                                    North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	1500	5100	0
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	7.5%	9.7%	12.0%
Southbound	15.9%	22.1%	17.5%
Eastbound	13.3%	16.9%	0.0%
Westbound	8.4%	16.1%	11.2%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 68.9%

LEVEL OF SERVICE ----> B

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Orange Avenue — Year 1992 w/o Project
EW : Palomar Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                      0     0     0
                      |     |     |
                   <--'     v     `-->
          ^           0     1     0       ^
   0 ----'   0                      0  `----   0
 611 ----->  2                      2 <-----  432
 407 ----,   1                      1  ,----   14

          v                                v
                    1.5     0   0.5
                   <--,     ^    ,-->
                      |     |     |        ^
                    264     0     3        |
                                         North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	2250	0	750
Southbound	0	1500	0
Eastbound	0	3400	1500
Westbound	1500	3400	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	11.7%	0.0%	0.4%
Southbound	0.0%	0.0%	0.0%
Eastbound	0.0%	18.0%	27.1%
Westbound	0.9%	12.7%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 48.9%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway — Year 1992 w/o Project
EW : Anita Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                  68   624   70
                   |    |    |
                <--'    v    `-->
        ^          0    2    1        ^
 133 ----'  0                    0  `----  62
 198 -----> 1                    1 <-----  100
  87 ----,  0                    0  ,----  22

        v                             v
                   1    2    0
                <--,    ^    ,-->
                   |    |    |         ^
                  32   441   50        |
                                     North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	0
Southbound	1500	3400	0
Eastbound	0	1500	0
Westbound	0	1500	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	2.1%	14.4%	0.0%
Southbound	4.7%	20.4%	0.0%
Eastbound	0.0%	27.9%	0.0%
Westbound	0.0%	12.3%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 60.4%

LEVEL OF SERVICE ----> B

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway — Year 1992 w/o Project
EW : Main Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                    101   539   219
                     |     |     |
                  <--'     v     '-->
              ^      1     2     1       ^
 129 ----'    1                    0  '----  186
 750 ----->   2                    2  <----  851
 149 ----,    0                    1  ,----  222

              v                          v
                     1     2     1
                  <--,     ^     ,-->
                     |     |     |           ^
                    291   511   177          |
                                           North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	1500	3400	0
Westbound	1500	3400	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	19.4%	15.0%	11.8%
Southbound	14.6%	15.9%	6.7%
Eastbound	8.6%	26.4%	0.0%
Westbound	14.8%	30.5%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 86.5%

LEVEL OF SERVICE ----> D

APPENDIX C

ICU CALCULATION WORKSHEETS
FUTURE YEAR 1992 - WITH PROJECT
PM PEAK HOUR

INTERSECTION CAPACITY UTILIZATION MODEL

NS : I-5 SB RAMP   Year 1992 w/ Project
EW : Palomar Street   PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                180    0   589
                 :     :    :
               <--'    v    `-->
        ^       0.5    0   1.5      ^
  0 ----'  0                   0 `----   0
329 -----> 2                   1 <-----  106
149 ----,  0                   1  ,----  575

        v                           v
                 0     0     0
              <--,     ^     ,-->
                 :     :     :      ^
                 0     0     0      :
                                  North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	0	0	0
Southbound	2250	0	750
Eastbound	0	3400	0
Westbound	0	3000	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	0.0%	0.0%	0.0%
Southbound	26.2%	0.0%	24.0%
Eastbound	0.0%	14.1%	0.0%
Westbound	0.0%	22.7%	0.0%

EFFICIENCY LOST FACTOR   0.1

CAPACITY UTILIZATION

Percent Utilization   58.9%

LEVEL OF SERVICE   ---->   A

INTERSECTION CAPACITY UTILIZATION MODEL

```
NS : I-5 NB RAMP                Year 1992 w/ Project
EW : Palomar Street             PM PEAK
```

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                   0     0     0
                   |     |     |
               <--'      v     `-->
        ^          0     0     0       ^
  53 ----'   0                    1  `----  684
 864 -----> 2                     2 <-----  626
   0 ----,   0                    0  ,----    0

        v                              v
                   1     0     2
               <--,      ^     ,-->
                   |     |     |       ^
                  53     0   607       |
                                     North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	0	2700
Southbound	0	0	0
Eastbound	0	3200	0
Westbound	0	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	3.5%	0.0%	22.5%
Southbound	0.0%	0.0%	0.0%
Eastbound	0.0%	28.7%	0.0%
Westbound	0.0%	18.4%	45.6%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 78.1%

LEVEL OF SERVICE ----> C

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Industrial Blvd — Year 1992 w/ Project
EW : Palomar Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                   53   117    39
                    |    |     |
                    |    |     |
                (--'     v     '--)
          ^                           ^
                    1    1     0
    67 ----'   1                   1  '----    90
  1347 -----)  2                   2 (-----  1182
    67 ----,   0                   1  ,----    53

          v                           v
                    0    1     1
                (--,     ^     ,--)
                   |     |     |        ^
                   |     |     |        |
                  121    92   109       |
                                      North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	0	1500	1500
Southbound	0	1500	1500
Eastbound	1500	3400	0
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	0.0%	14.2%	7.3%
Southbound	0.0%	10.4%	3.5%
Eastbound	4.5%	41.6%	0.0%
Westbound	3.5%	34.8%	6.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 69.3%

LEVEL OF SERVICE ----> B

INTERSECTION CAPACITY UTILIZATION MODEL

```
NS : Trolley Station          Year 1992 w/ Project
EW : Palomar Street           PM PEAK
```

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                   92     3    10
                    :     :     :
                 <--'     v     '-->
         ^          0     1     1       ^
    92 ----'  1                     1  '----  24
  1184 -----> 2                     2 <----- 1386
   106 ----,  1                     1  ,----  124

         v                              v
                    1     1     0
                 <--,     ^     ,-->
                    :     :     :       ^
                  120     4   103       :
                                      North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	1700	0
Southbound	1500	1700	0
Eastbound	1500	3400	1500
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	8.0%	6.3%	0.0%
Southbound	0.7%	5.6%	0.0%
Eastbound	6.1%	34.8%	7.1%
Westbound	8.3%	40.8%	1.6%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 70.5%

LEVEL OF SERVICE ----> C

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Center Entrance Year 1992 w/ Project
EW : Palomar Street PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                 36     0    65
                  |     |     |
              <--'      v     '-->
          ^       0     1     1      ^
  17 ----'  1                     0  '----  28
1329 -----> 2                     2 <----- 1251
 174 ----,  0                     1  ,----  300

          v                          v
                  1     1     0
              <--,      ^     ,-->
                 |      |     |          ^
                224     0    250         |
                                       North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	1700	0
Southbound	1500	1700	0
Eastbound	1500	3400	0
Westbound	1500	3400	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	14.9%	14.7%	0.0%
Southbound	4.3%	2.1%	0.0%
Eastbound	1.1%	44.2%	0.0%
Westbound	20.0%	37.6%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 93.2%

LEVEL OF SERVICE ----> E

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway　　　　　Year 1992 w/ Project
EW : Palomar Street　　　PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                 349   831   239
                  |     |     |
               <--'     v     '-->
        ^         1     2     1       ^
278 ----'   1                     1   `---- 168
812 ----->  3                     2 <------ 591
148 ----,   0                     1   ,---- 126

        v                             v
                  1     2     1
               <--,     ^     ,-->
                  |     |     |       ^
                 170   409   180      |
                                    North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	1500	5100	0
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	11.3%	12.0%	12.0%
Southbound	15.9%	24.4%	23.3%
Eastbound	18.5%	18.3%	0.0%
Westbound	8.4%	17.4%	11.2%

EFFICIENCY LOST FACTOR　　0.1

CAPACITY UTILIZATION

Percent Utilization　81.7%

LEVEL OF SERVICE　---->　D

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Orange Avenue — Year 1992 w/ Project
EW : Palomar Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                    0     0     0
                    |     |     |
                 <--'     v     '-->
         ^          0     1     0        ^
   0 ----'  0                      0  '----   0
 656 -----> 2                      2 <-----  455
 429 ----,  1                      1  ,----   14

         v                               v
                 1.5      0   0.5
                <--,      ^    ,-->
                   |      |    |         ^
                  287     0    3         |
                                       North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	2250	0	750
Southbound	0	1500	0
Eastbound	0	3400	1500
Westbound	1500	3400	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	12.8%	0.0%	0.4%
Southbound	0.0%	0.0%	0.0%
Eastbound	0.0%	19.3%	28.6%
Westbound	0.9%	13.4%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 51.4%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway — Year 1992 w/ Project
EW : Anita Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                    95    669    79
                     |     |     |
                     |     |     |
                 <--'      v     '--)
         ^                                 ^
                     0     2     1
   160 ----'   0                      0  '----   22
   198 ----->  1                      1 <-----  100
    87 ----,   0                      0  ,----   71

         v                                 v
                     1     2     0
                 <--,      ^     ,-->
                   |       |     |         ^
                   |       |     |         |
                  32      486    50        |
                                         North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	0
Southbound	1500	3400	0
Eastbound	0	1500	0
Westbound	0	1500	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	2.1%	15.8%	0.0%
Southbound	5.3%	22.5%	0.0%
Eastbound	0.0%	29.7%	0.0%
Westbound	0.0%	12.9%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 64.3%

LEVEL OF SERVICE ----> B

NS : Broadway — Year 1992 w/ Project
EW : Main Street — PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                  110   566   228
                    |     |     |
                 <--'     v     '-->
      ^             1     2     1       ^
138 ----'  1                      0  '----  198
750 -----> 2                      2 <-----  851
149 ----,  0                      1  ,----  222

      v                                 v
                  1     2     1
                <--,    ^    ,-->
                   |    |    |          ^
                  291  538  177         |
                                      North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	1500	3400	0
Westbound	1500	3400	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	19.4%	15.8%	11.8%
Southbound	15.2%	16.6%	7.3%
Eastbound	9.2%	26.4%	0.0%
Westbound	14.8%	30.9%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 87.3%

LEVEL OF SERVICE ----> D

APPENDIX D

ICU CALCULATION WORKSHEETS
FUTURE YEAR 1992 - WITH PROJECT AND MITIGATION
PM PEAK HOUR

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway   Year 1992 w/ Project
EW : Palomar Street   PM PEAK
Mitigation: 10 percent
reduction in project size

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                239   823   239
                 :     :     :
               <--'    v     '-->
         ^        1     2     1       ^
 270 ----'   1                    1  `----  168
 807 -----> 3                    2 <-----  586
 143 ----,  0                    1  ,----  126

         v                            v
                  1     2     1
               <--,    ^     ,-->
                 :     :     :        ^
                161   401   180       :
                                    North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	1500	5100	0
Westbound	1500	3400	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	10.7%	11.8%	12.0%
Southbound	15.9%	24.2%	15.9%
Eastbound	18.0%	18.6%	0.0%
Westbound	8.4%	17.2%	11.2%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 80.2%

LEVEL OF SERVICE ----> D

```
NS : Broadway                 Year 1992 w/ Project
EW : Main Street              PM PEAK
                              Mitigation: 10 percent
                              reduction in project size
```

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                 109   563   227
                   |     |     |
                   |     |     |
                (--'     v     '--)
         ^         1     2     1      ^
  137 ----'  1                   0  '----  197
  750 -----> 2                   2 <-----  851
  149 ----,  0                   1  ,----  222

         v                            v
                   1     2     1
                (--,     ^     ,--)
                   |     |     |       ^
                   |     |     |       |
                 291   535   177       |
                                     North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	1500	3400	0
Westbound	1500	3400	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	19.4%	15.7%	11.8%
Southbound	15.1%	16.6%	7.3%
Eastbound	9.1%	26.4%	0.0%
Westbound	14.8%	30.8%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 87.2%

LEVEL OF SERVICE ----> D

INTERSECTION CAPACITY UTILIZATION MODEL

```
NS : Industrial Blvd            Year 1992 w/ Project
EW : Palomar Street             PM PEAK
                           Mitigation: 1 EB T, 1 WB T
```

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                    53   117    39
                     |    |     |
                 <--'     v     '-->
          ^          1    1     0        ^
   67 ----'   1                     1  '----   90
 1347 -----> 3                      3 <----- 1182
   67 ----,   0                     1  ,----   53

          v                              v
                     0    1     1
                 <--,     ^     ,-->
                    |     |     |        ^
                   121    92   109       |
                                       North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	0	1500	1500
Southbound	0	1500	1500
Eastbound	1500	5100	0
Westbound	1500	5100	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	0.0%	14.2%	7.3%
Southbound	0.0%	10.4%	3.5%
Eastbound	4.5%	27.7%	0.0%
Westbound	3.5%	23.2%	6.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 55.5%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

```
NS : Trolley Station            Year 1992 w/ Project
EW : Palomar Street             PM PEAK
                            Mitigation: 1 EB T, 1 WB T
```

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                    93     3    10
                     |     |     |
                  ,--'     |     |
                 <--'      v     '-->
         ^           0     1     1       ^
   92 ----'   1                       1  '----   24
 1189 -----> 3                        3 <----- 1386
  106 ----,   1                       1  ,----  124

         v                                v
                     1     1     0
                 <--,      ^     ,-->
                    |      |     |
                    |      |     |
                   120     4    103      ^
                                         |
                                       North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	1700	0
Southbound	1500	1700	0
Eastbound	1500	5100	1500
Westbound	1500	5100	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	8.0%	6.3%	0.0%
Southbound	0.7%	5.6%	0.0%
Eastbound	6.1%	23.3%	7.1%
Westbound	8.3%	27.2%	1.6%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 57.0%

LEVEL OF SERVICE ----> A

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Center Entrance — Year 1992 w/ Project
EW : Palomar Street — MITIGATED PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                   36     0     65
                    |     |     |
                 <--'     v     '-->
          ^         0     1     1         ^
   17 ----'   1                     0  '----   28
 1329 ----->  3                     3  <----- 1251
  174 ----,   1                     2  ,----  300

          v                                v
                    1     1     0
                 <--,     ^     ,-->
                    |     |     |         ^
                   224    0    250        |
                                        North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	1700	0
Southbound	1500	1700	0
Eastbound	1500	5100	1500
Westbound	2700	5100	0

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	14.9%	14.7%	0.0%
Southbound	4.3%	2.1%	0.0%
Eastbound	1.1%	26.1%	11.6%
Westbound	11.1%	25.1%	0.0%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 66.2%

LEVEL OF SERVICE ----> B

INTERSECTION CAPACITY UTILIZATION MODEL

NS : Broadway — Year 1992 w/ Project

EW : Palomar Street — Mitigated PM PEAK

INTERSECTION TURNING MOVEMENTS / LANE GEOMETRY

```
                      349   831   239
                       |     |     |
                     <--'    v     '-->
            ^           1     2     1       ^
  278 ----'   2                         1  '----  168
  812 ----->  3                         3 <-----  591
  148 ----,   0                         1  ,----  126

            v                                v
                        1     2     1
                     <--,     ^     ,-->
                        |     |     |        ^
                       170   409   180       |
                                           North
```

LANE GROUP CAPACITY

	Left Turn	Through	Right Turn
Default Capacity	1500	1700	1500
Northbound	1500	3400	1500
Southbound	1500	3400	1500
Eastbound	2700	5100	0
Westbound	1500	5100	1500

VOLUME/CAPACITY RATIO

	Left Turn	Through	Right Turn
Northbound	11.3%	12.0%	12.0%
Southbound	15.9%	24.4%	23.3%
Eastbound	10.3%	18.8%	0.0%
Westbound	8.4%	11.6%	11.2%

EFFICIENCY LOST FACTOR 0.1

CAPACITY UTILIZATION

Percent Utilization 73.0%

LEVEL OF SERVICE ----> C

APPENDIX E

HCM CALCULATION WORKSHEETS
PM PEAK HOUR

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/INDUSTRIAL BOULEVARD
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/22/91
TIME..........PM PEAK HOUR
COMMENT.......EXISTING CONDITION

VOLUMES					:	GEOMETRY							
	EB	WB	NB	SB	:	EB		WB		NB		SB	
LT	63	21	114	16	:	L	12.0	L	12.0	LT	12.0	LT	12.0
TH	1142	987	89	110	:	T	12.0	T	12.0	R	12.0	R	12.0
RT	63	64	75	51	:	TR	12.0	T	12.0		12.0		12.0
RR	0	0	0	0	:		12.0	R	12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.92	5	Y	16.8	3
WB	0.00	2.00	Y	20	0	0.92	18	Y	16.8	3
NB	0.00	2.00	Y	20	0	0.92	0	Y	28.8	3
SB	0.00	2.00	Y	20	0	0.92	32	Y	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 59.5

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH	X			
	RT	X					RT	X			
	PD	X					PD	X			
WB	LT	X				SB	LT	X			
	TH	X					TH	X			
	RT	X					RT	X			
	PD	X					PD	X			
GREEN		28.0	0.0	0.0	0.0	GREEN		22.0	0.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		4.5	0.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.415	0.504	8.0	B	23.9	C
	TR	0.996	0.504	24.7	C		
WB	L	0.188	0.504	6.2	B	8.2	B
	T	0.721	0.504	9.4	B		
	R	0.132	0.504	5.1	B		
NB	LT	0.382	0.395	8.5	B	8.2	B
	R	0.170	0.375	7.6	B		
SB	LT	0.209	0.395	7.7	B	7.6	B
	R	0.118	0.395	7.4	B		

INTERSECTION: Delay = 15.[illegible] (sec/veh) V/C = 0.727 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/TROLLEY ENTRANCE
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........01/18/91
TIME..........PM PEAK HOUR
COMMENT.......EXISTING CONDITION

VOLUMES

	EB	WB	NB	SB
LT	89	47	22	9
TH	1163	1108	4	3
RT	26	23	72	89
RR	0	0	0	0

GEOMETRY

EB		WB		NB		SB	
L	12.0	L	12.0	L	12.0	L	12.0
T	12.0	T	12.0	TR	12.0	TR	12.0
T	12.0	T	12.0		12.0		12.0
R	12.0	R	12.0		12.0		12.0
	12.0		12.0		12.0		12.0
	12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	42	N	16.8	3
WB	0.00	2.00	Y	20	0	0.97	10	N	16.8	3
NB	0.00	2.00	Y	20	0	0.97	51	N	28.8	3
SB	0.00	2.00	Y	20	0	0.97	0	N	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 55.0

		PH-1	PH-2	PH-3	PH-4
EB	LT	X			
	TH		X		
	RT		X		
	PD		X		
WB	LT	X			
	TH		X		
	RT		X		
	PD		X		
GREEN		9.0	26.0	0.0	0.0
YELLOW		3.5	5.0	0.0	0.0

		PH-1	PH-2	PH-3	PH-4
NB	LT	X			
	TH	X			
	RT	X			
	PD	X			
SB	LT	X			
	TH	X			
	RT	X			
	PD	X			
GREEN		7.0	0.0	0.0	0.0
YELLOW		4.5	0.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.314	0.173	15.3	C	7.8	B
	T	0.694	0.509	7.3	B		
	R	0.044	0.509	4.4	A		
WB	L	0.166	0.173	14.8	B	7.2	B
	T	0.661	0.509	7.0	B		
	R	0.039	0.509	4.4	A		
NB	L	0.084	0.155	15.1	C	14.6	B
	TR	0.426	0.155	14.4	B		
SB	L	0.034	0.155	15.0	C	15.3	C
	TR	0.504	0.155	15.3	C		

INTERSECTION: Delay = 8.1 (sec/veh) V/C = 0.580 LOS = B

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/BROADWAY
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......EXISTING CONDITION

	VOLUMES				GEOMETRY							
	EB	WB	NB	SB		EB		WB		NB		SB
LT	188	119	106	225	L	12.0	L	12.0	L	12.0	L	12.[illegible]
TH	723	515	311	709	T	12.0	T	12.0	T	12.0	T	12.[illegible]
RT	89	158	170	248	T	12.0	T	12.0	T	12.0	T	12.0
RR	0	0	0	0	TR	12.0	R	12.0	R	12.0	R	12.[illegible]
						12.0		12.0		12.0		12.[illegible]
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	22	Y	25.8	3
WB	0.00	2.00	Y	20	0	0.97	12	Y	25.8	3
NB	0.00	2.00	Y	20	0	0.97	9	Y	28.8	3
SB	0.00	2.00	Y	20	0	0.97	11	Y	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 96.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X	X			NB	LT	X			
	TH		X	X			TH			X	
	RT		X	X			RT			X	
	PD			X			PD			X	
WB	LT	X				SB	LT	X	X		
	TH			X			TH		X	X	
	RT			X			RT		X	X	
	PD			X			PD			X	
GREEN		12.0	4.0	21.0	0.0	GREEN		7.0	5.0	25.0	0.0
YELLOW		3.5	2.0	5.0	0.0	YELLOW		3.3	3.0	5.0	0.[illegible]

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.594	0.193	29.0	D	20.8	C
	TR	0.624	0.302	17.1	C		
WB	L	0.557	0.130	32.1	D	23.8	C
	T	0.653	0.240	22.3	C		
	R	0.565	0.240	22.4	C		
NB	L	0.826	0.078	55.2	E	24.9	C
	T	0.326	0.281	17.8	C		
	R	0.517	0.281	19.7	C		
SB	L	0.849	0.161	44.4	E	22.2	C
	T	0.591	0.365	16.4	C		
	R	0.636	0.333	19.5	C		

INTERSECTION: Delay = 22.[illegible] (sec/veh) V/C = 0.629 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/ORANGE AVENUE
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......EXISTING CONDITION

VOLUMES	EB	WB	NB	SB	GEOMETRY	EB		WB		NB		SB
LT	0	13	249	0	T	12.0	L	11.0	L	12.0	LTR	12.0
TH	576	407	0	0	T	12.0	T	11.0	LR	12.0		12.0
RT	384	0	3	0	R	12.0	T	11.0		12.0		12.0
RR	140	0	0	0		12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	22	Y	16.8	3
WB	0.00	2.00	Y	20	0	0.97	12	Y	16.8	3
NB	0.00	2.00	Y	20	0	0.97	9	Y	25.0	3
SB	0.00	2.00	Y	20	0	0.97	11	Y	25.0	3

SIGNAL SETTINGS CYCLE LENGTH = 103.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X	X			NB	LT	X			
	TH		X	X			TH				
	RT		X	X			RT	X			
	PD			X			PD				
WB	LT	X				SB	LT				
	TH			X			TH				
	RT			X			RT				
	PD			X			PD				
GREEN		13.0	4.0	25.0	0.0	GREEN		40.0	0.0	0.0	0.0
YELLOW		3.5	2.0	5.0	0.0	YELLOW		5.5	0.0	5.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	T	0.546	0.320	19.0	C	20.8	C
	R	0.722	0.291	25.3	D		
WB	L	0.062	0.131	29.8	D	21.9	C
	T	0.546	0.262	21.7	C		
NB	L	0.413	0.413	16.5	C	16.5	C
	LR	0.006	0.413	11.5	B		

INTERSECTION: Delay = 20.4 (sec/veh) V/C = 0.387 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****

INTERSECTION..PALOMAR STREET/INDUSTRIAL BOULEVARD
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/22/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/O PROJECT

VOLUMES					:	GEOMETRY							
	EB	WB	NB	SB	:		EB		WB		NB		SB
LT	64	22	121	16	:	L	12.0	L	12.0	LT	12.0	LT	12.
TH	1212	1047	92	117	:	T	12.0	T	12.0	R	12.0	R	12.
RT	67	68	77	53	:	TR	12.0	T	12.0		12.0		12.0
RR	0	0	0	0	:		12.0	R	12.0		12.0		12.
					:		12.0		12.0		12.0		12.
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.92	5	Y	16.8	3
WB	0.00	2.00	Y	20	0	0.92	18	Y	16.8	3
NB	0.00	2.00	Y	20	0	0.92	0	Y	28.8	3
SB	0.00	2.00	Y	20	0	0.92	32	Y	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 59.5

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH	X			
	RT	X					RT	X			
	PD	X					PD	X			
WB	LT	X				SB	LT	X			
	TH	X					TH	X			
	RT	X					RT	X			
	PD	X					PD	X			
GREEN		28.0	0.0	0.0	0.0	GREEN		22.0	0.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		4.5	0.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.479	0.504	9.3	B	38.7	D
	TR	1.058	0.504	40.1	E		
WB	L	0.226	0.504	6.5	B	8.8	B
	T	0.764	0.504	9.1	B		
	R	0.140	0.504	5.1	B		
NB	LT	0.408	0.395	8.6	B	8.3	B
	R	0.175	0.395	7.6	B		
SB	LT	0.221	0.395	7.7	B	7.6	B
	R	0.123	0.395	7.4	B		

INTERSECTION: Delay = 22.4 (sec/veh) V/C = 0.772 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

****

INTERSECTION..PALOMAR STREET/TROLLEY ENTRANCE
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........01/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/O PROJECT

	VOLUMES				:	GEOMETRY							
	EB	WB	NB	SB	:	EB		WB		NB		SB	
LT	92	48	23	10	:	L	12.0	L	12.0	L	12.0	L	12.0
TH	1234	1175	4	3	:	T	12.0	T	12.0	TR	12.0	TR	12.0
RT	28	24	74	92	:	T	12.0	T	12.0		12.0		12.0
RR	0	0	0	0	:	R	12.0	R	12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ Y/N	PKG Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	42	N	16.8	3
WB	0.00	2.00	Y	20	0	0.97	10	N	16.8	3
NB	0.00	2.00	Y	20	0	0.97	51	N	28.8	3
SB	0.00	2.00	Y	20	0	0.97	0	N	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 55.0

		PH-1	PH-2	PH-3	PH-4
EB	LT	X			
	TH		X		
	RT		X		
	PD		X		
WB	LT	X			
	TH		X		
	RT		X		
	PD		X		
GREEN		9.0	26.0	0.0	0.0
YELLOW		3.5	5.0	0.0	0.0

		PH-1	PH-2	PH-3	PH-4
NB	LT	X			
	TH	X			
	RT	X			
	PD	X			
SB	LT	X			
	TH	X			
	RT	X			
	PD	X			
GREEN		7.0	0.0	0.0	0.0
YELLOW		4.5	0.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.324	0.173	15.4	C	8.2	B
	T	0.736	0.509	7.8	B		
	R	0.048	0.509	4.4	A		
WB	L	0.169	0.173	14.8	B	7.6	B
	T	0.701	0.509	7.4	B		
	R	0.040	0.509	4.4	A		
NB	L	0.089	0.155	15.2	C	14.7	B
	TR	0.437	0.155	14.5	B		
SB	L	0.037	0.155	15.0	C	15.5	C
	TR	0.520	0.155	15.6	C		

INTERSECTION: Delay = 8.4 (sec/veh) V/C = 0.611 LOS = B

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****

INTERSECTION..PALOMAR STREET/BROADWAY
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/O PROJECT

VOLUMES	EB	WB	NB	SB	GEOMETRY	EB		WB		NB		SB
LT	199	126	112	239	L	12.0	L	12.0	L	12.0	L	12.0
TH	767	546	330	752	T	12.0	T	12.0	T	12.0	T	12.
RT	94	168	180	263	T	12.0	T	12.0	T	12.0	T	12.
RR	0	0	0	0	TR	12.0	R	12.0	R	12.0	R	12.0
						12.0		12.0		12.0		12.
						12.0		12.0		12.0		12.

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYP
EB	0.00	2.00	Y	20	0	0.97	22	Y	25.8	3
WB	0.00	2.00	Y	20	0	0.97	12	Y	25.8	3
NB	0.00	2.00	Y	20	0	0.97	9	Y	28.8	3
SB	0.00	2.00	Y	20	0	0.97	11	Y	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 9

		PH-1	PH-2	PH-3	PH-4
EB	LT	X	X		
	TH		X	X	
	RT		X	X	
	PD			X	
WB	LT	X			
	TH			X	
	RT			X	
	PD			X	
GREEN		12.0	4.0	21.0	0.0
YELLOW		3.5	2.0	5.0	0.0

		PH-1	PH-2	PH-3	PH
NB	LT	X			
	TH			X	
	RT			X	
	PD			X	
SB	LT	X	X		
	TH		X	X	
	RT		X	X	
	PD			X	
GREEN		7.0	5.0	25.0	0.
YELLOW		3.5	3.0	5.0	0.

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.629	0.193	29.8	D	21.3	C
	TR	0.662	0.302	19.5	C		
WB	L	0.589	0.130	32.8	D	24.4	C
	T	0.692	0.240	22.9	C		
	R	0.601	0.240	23.1	C		
NB	L	0.873	0.078	62.5	F	26.4	D
	T	0.356	0.281	17.9	C		
	R	0.547	0.281	20.2	C		
SB	L	0.901	0.161	51.3	E	23.9	C
	T	0.626	0.365	16.8	C		
	R	0.675	0.333	20.4	C		

INTERSECTION: Delay = 23.7 (sec/veh) V/C = 0.667 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

****

INTERSECTION..PALOMAR STREET/ORANGE AVENUE
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/O PROJECT

	VOLUMES				:	GEOMETRY							
	EB	WB	NB	SB	:		EB		WB		NB		SB
LT	0	14	264	0	:	T	12.0	L	11.0	L	12.0	LTR	12.0
TH	611	432	0	0	:	T	12.0	T	11.0	LR	12.0		12.0
RT	407	0	3	0	:	R	12.0	T	11.0		12.0		12.0
RR	150	0	0	0	:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	22	Y	16.8	3
WB	0.00	2.00	Y	20	0	0.97	12	Y	16.8	3
NB	0.00	2.00	Y	20	0	0.97	9	Y	25.0	3
SB	0.00	2.00	Y	20	0	0.97	11	Y	25.0	3

SIGNAL SETTINGS CYCLE LENGTH = 103.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X	X			NB	LT	X			
	TH		X	X			TH				
	RT		X	X			RT	X			
	PD			X			PD				
WB	LT	X				SB	LT				
	TH			X			TH				
	RT			X			RT				
	PD			X			PD				
GREEN		13.0	4.0	25.0	0.0	GREEN		40.0	0.0	0.0	0.0
YELLOW		3.5	2.0	5.0	0.0	YELLOW		5.5	0.0	5.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	T	0.579	0.320	19.3	C	21.5	C
	R	0.758	0.291	26.8	D		
WB	L	0.067	0.131	29.8	D	22.3	C
	T	0.580	0.262	22.0	C		
NB	L	0.436	0.413	16.8	C	16.8	C
	LR	0.006	0.413	11.5	B		

INTERSECTION: Delay = 20.9 (sec/veh) V/C = 0.411 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/INDUSTRIAL BOULEVARD
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/22/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/ PROJECT

	VOLUMES				GEOMETRY							
	EB	WB	NB	SB	EB		WB		NB		SB	
LT	67	35	121	39	L	12.0	L	12.0	LT	12.0	LT	12.0
TH	1347	1182	92	117	T	12.0	T	12.0	R	12.0	R	12.0
RT	67	90	91	53	TR	12.0	T	12.0		12.0		12.0
RR	0	0	0	0		12.0	R	12.0		12.0		12.0
						12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.92	5	Y	16.8	3
WB	0.00	2.00	Y	20	0	0.92	18	Y	16.8	3
NB	0.00	2.00	Y	20	0	0.92	0	Y	28.8	3
SB	0.00	2.00	Y	20	0	0.92	32	Y	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 59.5

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH	X			
	RT	X					RT	X			
	PD	X					PD	X			
WB	LT	X				SB	LT	X			
	TH	X					TH	X			
	RT	X					RT	X			
	PD	X					PD	X			
GREEN		28.0	0.0	0.0	0.0	GREEN		22.0	0.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		4.5	0.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.680	0.504	19.0	C	83.4	F
	TR	1.168	0.504	86.3	F		
WB	L	0.364	0.504	7.8	B	11.0	B
	T	0.863	0.504	11.6	B		
	R	0.186	0.504	5.2	B		
NB	LT	0.430	0.395	8.8	B	8.5	B
	R	0.207	0.395	7.7	B		
SB	LT	0.308	0.395	8.1	B	7.9	B
	R	0.123	0.395	7.4	B		

INTERSECTION: Delay = 43.4 (sec/veh) V/C = 0.844 LOS = E

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/TROLLEY ENTRANCE
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........01/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/ PROJECT

VOLUMES					:	GEOMETRY							
	EB	WB	NB	SB	:	EB		WB		NB		SB	
LT	92	124	120	10	:	L	12.0	L	12.0	L	12.0	L	12.0
TH	1166	1368	4	3	:	T	12.0	T	12.0	TR	12.0	TR	12.0
RT	106	24	103	89	:	T	12.0	T	12.0		12.0		12.0
RR	0	0	0	0	:	R	12.0	R	12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ Y/N	PKG Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	42	N	16.8	3
WB	0.00	2.00	Y	20	0	0.97	10	N	16.8	3
NB	0.00	2.00	Y	20	0	0.97	51	N	28.8	3
SB	0.00	2.00	Y	20	0	0.97	0	N	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 55.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH		X				TH	X			
	RT		X				RT	X			
	PD		X				PD	X			
WB	LT	X				SB	LT	X			
	TH		X				TH	X			
	RT		X				RT	X			
	PD		X				PD	X			
GREEN		9.0	26.0	0.0	0.0	GREEN		7.0	0.0	0.0	0.0
YELLOW		3.5	5.0	0.0	0.0	YELLOW		4.5	0.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.324	0.173	15.4	C	7.7	B
	T	0.696	0.509	7.3	B		
	R	0.181	0.509	4.7	A		
WB	L	0.437	0.173	16.2	C	9.6	B
	T	0.816	0.509	9.1	B		
	R	0.040	0.509	4.4	A		
NB	L	0.461	0.155	17.0	C	17.1	C
	TR	0.602	0.155	17.3	C		
SB	L	0.040	0.155	15.0	C	15.3	C
	TR	0.504	0.155	15.3	C		

INTERSECTION: Delay = 9.5 (sec/veh) V/C = 0.698 LOS = B

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/CENTER STREET
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/PROJECT

VOLUMES	EB	WB	NB	SB	GEOMETRY	EB		WB		NB		SB
LT	17	300	216	65	L	12.0	L	12.0	L	12.0	L	12.
TH	1329	1251	0	0	T	12.0	T	12.0	TR	12.0	TR	12.
RT	166	28	250	36	TR	12.0	TR	12.0		12.0		12.0
RR	100	20	135	28		12.0		12.0		12.0		12.
						12.0		12.0		12.0		12.
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ Y/N	PKG Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	22	N	19.8	3
WB	0.00	2.00	Y	20	0	0.97	12	N	19.8	3
NB	0.00	2.00	Y	20	0	0.97	9	N	25.8	3
SB	0.00	2.00	Y	20	0	0.97	11	N	25.8	3

SIGNAL SETTINGS CYCLE LENGTH = 130.0

		PH-1	PH-2	PH-3	PH-4
EB	LT	X			
	TH			X	
	RT			X	
	PD			X	
WB	LT	X	X		
	TH		X	X	
	RT		X	X	
	PD			X	
GREEN		10.0	37.0	48.0	0.0
YELLOW		3.5	2.0	5.0	0.0

		PH-1	PH-2	PH-3	PH-
NB	LT	X	X		
	TH		X		
	RT		X		
	PD				
SB	LT	X	X		
	TH		X		
	RT		X		
	PD				
GREEN		6.0	10.0	0.0	0.0
YELLOW		3.5	5.0	0.0	0.

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.128	0.081	42.2	E	110.6	F
	TR	1.182	0.385	111.3	F		
WB	L	0.480	0.381	23.6	C	10.6	B
	TR	0.627	0.685	7.7	B		
NB	L	0.761	0.165	55.0	E	75.5	F
	TR	1.061	0.092	113.9	F		
SB	L	0.081	0.165	34.9	D	34.9	D
	TR	0.073	0.092	34.8	D		

INTERSECTION: Delay = 59.5 (sec/veh) V/C = 0.946 LOS = E

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****

INTERSECTION..PALOMAR STREET/BROADWAY
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/PROJECT

	VOLUMES				:	GEOMETRY							
	EB	WB	NB	SB	:	EB		WB		NB		SB	
LT	278	126	170	239	:	L	12.0	L	12.0	L	12.0	L	12.0
TH	812	591	409	831	:	T	12.0	T	12.0	T	12.0	T	12.0
RT	148	168	180	349	:	T	12.0	T	12.0	T	12.0	T	12.0
RR	65	75	40	130	:	TR	12.0	R	12.0	R	12.0	R	12.0
					:		12.0		12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	22	Y	25.8	3
WB	0.00	2.00	Y	20	0	0.97	12	Y	25.8	3
NB	0.00	2.00	Y	20	0	0.97	9	Y	28.8	3
SB	0.00	2.00	Y	20	0	0.97	11	Y	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 96.0

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X	X			NB	LT	X			
	TH		X	X			TH			X	
	RT		X	X			RT			X	
	PD			X			PD			X	
WB	LT	X				SB	LT	X	X		
	TH			X			TH		X	X	
	RT			X			RT		X	X	
	PD			X			PD			X	
GREEN		12.0	8.0	17.0	0.0	GREEN		12.0	5.0	20.0	0.0
YELLOW		3.5	2.0	5.0	0.0	YELLOW		3.5	3.0	5.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.722	0.234	30.1	D	22.1	C
	TR	0.686	0.302	19.9	C		
WB	L	0.589	0.130	32.8	D	32.3	D
	T	0.907	0.198	33.7	D		
	R	0.404	0.198	22.2	C		
NB	L	0.795	0.130	42.9	E	26.6	D
	T	0.542	0.229	21.5	C		
	R	0.523	0.229	22.2	C		
SB	L	0.682	0.214	30.0	D	23.7	C
	T	0.808	0.313	22.3	C		
	R	0.666	0.281	22.6	C		

INTERSECTION: Delay = 25.5 (sec/veh) V/C = 0.805 LOS = D

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

****

INTERSECTION..PALOMAR STREET/ORANGE AVENUE
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/ PROJECT

	VOLUMES				GEOMETRY							
	EB	WB	NB	SB	EB		WB		NB		SB	
LT	0	14	287	0	T	12.0	L	11.0	L	12.0	LTR	12.0
TH	656	455	0	0	T	12.0	T	11.0	LR	12.0		12.0
RT	429	0	3	0	R	12.0	T	11.0		12.0		12.0
RR	150	0	0	0		12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	22	Y	16.8	3
WB	0.00	2.00	Y	20	0	0.97	12	Y	16.8	3
NB	0.00	2.00	Y	20	0	0.97	9	Y	25.0	3
SB	0.00	2.00	Y	20	0	0.97	11	Y	25.0	3

SIGNAL SETTINGS CYCLE LENGTH = 103.0

		PH-1	PH-2	PH-3	PH-4
EB	LT	X	X		
	TH		X	X	
	RT		X	X	
	PD			X	
WB	LT	X			
	TH			X	
	RT			X	
	PD			X	
GREEN		13.0	4.0	25.0	0.0
YELLOW		3.5	2.0	5.0	0.0

		PH-1	PH-2	PH-3	PH-4
NB	LT	X			
	TH				
	RT	X			
	PD				
SB	LT				
	TH				
	RT				
	PD				
GREEN		40.0	0.0	0.0	0.0
YELLOW		5.5	0.0	5.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	T	0.622	0.320	19.8	C	22.9	C
	R	0.323	0.291	30.5	D		
WB	L	0.067	0.131	29.8	D	22.6	C
	T	0.611	0.262	22.4	C		
NB	L	0.476	0.413	17.3	C	17.2	C
	LR	0.006	0.413	11.5	B		

INTERSECTION: Delay = 21.9 (sec/veh) V/C = 0.443 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/INDUSTRIAL BOULEVARD
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/22/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 WITH PROJECT AND MITIGATION

VOLUMES					GEOMETRY							
	EB	WB	NB	SB	EB		WB		NB		SB	
LT	67	35	121	39	L	12.0	L	12.0	LT	12.0	LT	12.0
TH	1347	1182	92	117	T	12.0	T	12.0	R	12.0	R	12.0
RT	67	90	91	53	T	12.0	T	12.0		12.0		12.0
RR	0	0	0	0	TR	12.0	T	12.0		12.0		12.0
						12.0	R	12.0		12.0		12.0
						12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.92	5	Y	16.8	3
WB	0.00	2.00	Y	20	0	0.92	18	Y	16.8	3
NB	0.00	2.00	Y	20	0	0.92	0	Y	28.8	3
SB	0.00	2.00	Y	20	0	0.92	32	Y	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 59.5

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH	X					TH	X			
	RT	X					RT	X			
	PD	X					PD	X			
WB	LT	X				SB	LT	X			
	TH	X					TH	X			
	RT	X					RT	X			
	PD	X					PD	X			
GREEN		28.0	0.0	0.0	0.0	GREEN		22.0	0.0	0.0	0.0
YELLOW		5.0	0.0	0.0	0.0	YELLOW		4.5	0.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.667	0.504	17.9	C	9.3	B
	TR	0.781	0.504	9.9	B		
WB	L	0.364	0.504	7.8	B	7.0	B
	T	0.603	0.504	7.1	B		
	R	0.186	0.504	5.2	B		
NB	LT	0.430	0.395	8.6	B	8.5	B
	R	0.207	0.395	7.7	B		
SB	LT	0.308	0.395	9.1	B	7.9	B
	R	0.123	0.395	7.4	B		

INTERSECTION: Delay = 8.2 (sec/veh) V/C = 0.627 LOS = B

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT
****
INTERSECTION..PALOMAR STREET/TROLLEY ENTRANCE
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........01/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/ PROJECT AND MITIGATION

	VOLUMES				:	GEOMETRY							
	EB	WB	NB	SB	:		EB		WB		NB		SB
LT	92	124	120	10	:	L	12.0	L	12.0	L	12.0	L	12.0
TH	1166	1368	4	3	:	T	12.0	T	12.0	TR	12.0	TR	12.
RT	106	24	103	89	:	T	12.0	T	12.0		12.0		12.
RR	0	0	0	0	:	T	12.0	T	12.0		12.0		12.0
					:	R	12.0	R	12.0		12.0		12.
					:		12.0		12.0		12.0		12.

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYP
EB	0.00	2.00	Y	20	0	0.97	42	N	16.8	3
WB	0.00	2.00	Y	20	0	0.97	10	N	16.8	3
NB	0.00	2.00	Y	20	0	0.97	51	N	28.8	3
SB	0.00	2.00	Y	20	0	0.97	0	N	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 5'

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X				NB	LT	X			
	TH		X				TH	X			
	RT		X				RT	X			
	PD		X				PD	X			
WB	LT	X				SB	LT	X			
	TH		X				TH	X			
	RT		X				RT	X			
	PD		X				PD	X			
GREEN		9.0	26.0	0.0	0.0	GREEN		7.0	0.0	0.0	0.
YELLOW		3.5	5.0	0.0	0.0	YELLOW		4.5	0.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.324	0.173	15.4	C	6.3	B
	T	0.486	0.509	5.8	B		
	R	0.181	0.509	4.7	A		
WB	L	0.437	0.173	16.2	C	6.9	B
	T	0.570	0.509	6.2	B		
	R	0.040	0.509	4.4	A		
NB	L	0.461	0.155	17.0	C	17.1	C
	TR	0.602	0.155	17.3	C		
SB	L	0.040	0.155	15.0	C	15.3	C
	TR	0.504	0.155	15.3	C		

INTERSECTION: Delay = 7.6 (sec/veh) V/C = 0.548 LOS = B

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

****

INTERSECTION..PALOMAR STREET/PROJECT ENTRANCE
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/ PROJECT AND MITIGATION

	VOLUMES				:	GEOMETRY							
	EB	WB	NB	SB	:	EB		WB		NB		SB	
LT	17	300	216	65	:	L	12.0	L	12.0	L	12.0	L	12.0
TH	1329	1251	0	0	:	T	12.0	L	12.0	TR	12.0	TR	12.0
RT	166	28	250	36	:	T	12.0	T	12.0		12.0		12.0
RR	100	20	135	28	:	TR	12.0	T	12.0		12.0		12.0
					:		12.0	TR	12.0		12.0		12.0
					:		12.0		12.0		12.0		12.0

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ PKG Y/N	Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYPE
EB	0.00	2.00	Y	20	0	0.97	22	N	19.8	3
WB	0.00	2.00	Y	20	0	0.97	12	N	19.8	3
NB	0.00	2.00	Y	20	0	0.97	9	N	25.8	3
SB	0.00	2.00	Y	20	0	0.97	11	N	25.8	3

SIGNAL SETTINGS CYCLE LENGTH = 130.0

		PH-1	PH-2	PH-3	PH-4
EB	LT	X			
	TH			X	
	RT			X	
	PD			X	
WB	LT	X	X		
	TH		X	X	
	RT		X	X	
	PD			X	
GREEN		10.0	37.0	48.0	0.0
YELLOW		3.5	2.0	5.0	0.0

		PH-1	PH-2	PH-3	PH-4
NB	LT	X	X		
	TH		X		
	RT		X		
	PD				
SB	LT	X	X		
	TH		X		
	RT		X		
	PD				
GREEN		6.0	10.0	0.0	0.0
YELLOW		3.5	5.0	0.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.128	0.081	42.2	E	24.4	C
	TR	0.790	0.385	24.2	C		
WB	L	0.260	0.381	21.1	C	8.7	B
	TR	0.419	0.685	5.9	B		
NB	L	0.883	0.165	72.7	F	87.1	F
	TR	1.061	0.092	113.9	F		
SB	L	0.277	0.165	36.4	D	36.2	D
	TR	0.073	0.092	34.8	D		

INTERSECTION: Delay = 23.0 (sec/veh) V/C = 0.607 LOS = C

1985 HCM: SIGNALIZED INTERSECTIONS
SUMMARY REPORT

****

INTERSECTION..PALOMAR STREET/BROADWAY
AREA TYPE.....OTHER
ANALYST.......JHK & ASSOCIATES
DATE..........1/18/91
TIME..........PM PEAK HOUR
COMMENT.......YEAR 1992 W/ PROJECT AND MITIGATION

	VOLUMES				:	GEOMETRY							
	EB	WB	NB	SB	:	EB		WB		NB		SB	
LT	278	126	170	239	:	L	12.0	L	12.0	L	12.0	L	12.0
TH	812	591	409	831	:	L	12.0	T	12.0	T	12.0	T	12
RT	148	168	180	349	:	T	12.0	T	12.0	T	12.0	T	12
RR	65	75	40	130	:	T	12.0	T	12.0	R	12.0	R	12.0
					:	T	12.0	R	12.0		12.0		12
					:	R	12.0		12.0		12.0		12

ADJUSTMENT FACTORS

	GRADE (%)	HV (%)	ADJ Y/N	PKG Nm	BUSES Nb	PHF	PEDS	PED. BUT. Y/N	min T	ARR. TYP
EB	0.00	2.00	Y	20	0	0.97	22	Y	25.8	3
WB	0.00	2.00	Y	20	0	0.97	12	Y	25.8	3
NB	0.00	2.00	Y	20	0	0.97	9	Y	28.8	3
SB	0.00	2.00	Y	20	0	0.97	11	Y	28.8	3

SIGNAL SETTINGS CYCLE LENGTH = 9

		PH-1	PH-2	PH-3	PH-4			PH-1	PH-2	PH-3	PH-4
EB	LT	X	X			NB	LT	X			
	TH		X	X			TH			X	
	RT		X	X			RT			X	
	PD			X			PD			X	
WB	LT	X				SB	LT	X	X		
	TH			X			TH		X	X	
	RT			X			RT		X	X	
	PD			X			PD			X	
GREEN		12.0	8.0	17.0	0.0	GREEN		12.0	5.0	20.0	0.
YELLOW		3.5	2.0	5.0	0.0	YELLOW		3.5	3.0	5.0	0.0

LEVEL OF SERVICE

	LANE GRP.	V/C	G/C	DELAY	LOS	APP. DELAY	APP. LOS
EB	L	0.392	0.234	23.7	C	19.7	C
	T	0.570	0.302	18.6	C		
	R	0.263	0.271	17.8	C		
WB	L	0.589	0.130	32.8	D	24.8	C
	T	0.633	0.198	23.6	C		
	R	0.404	0.198	22.2	C		
NB	L	0.795	0.130	42.9	E	26.6	D
	T	0.542	0.229	21.5	C		
	R	0.523	0.229	22.2	C		
SB	L	0.682	0.214	30.0	D	23.7	C
	T	0.808	0.313	22.3	C		
	R	0.666	0.281	22.6	C		

INTERSECTION: Delay = 23.2 (sec/veh) V/C = 0.691 LOS = C

APPENDIX F

ARTERIAL SIGNAL TIMING\SIGNAL SPACING ANALYSIS WORKSHEETS
PM PEAK HOUR

```
(ART.SUMY)
            TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-87      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  JUL 88

            **** PASSER-87 BEST PROGRESSION SOLUTION SUMMARY ****
 CHULA VISTA                  PALOMAR ST.     DISTRICT    01/14/91     RUN NO.   2

        CYCLE LENGTH  = 70 SECS       (MAXIMIN CYCLE  = 95 SECS)
        EFFICIENCY    =   .30         (GOOD PROGRESSION)
        ATTAINABILITY =  1.00         (INCREASE MIN. THROUGH PHASE)

        BAND A        = 25 SECS       AVERAGE SPEED  =  40 MPH
        BAND B        = 17 SECS       AVERAGE SPEED  =  40 MPH

   NOTE: ARTERIAL PROGRESSION EVALUATION CRITERIA
        ------------------------------------------------
        EFFICIENCY     0.00 - 0.12 - "POOR PROGRESSION"
                       0.13 - 0.24 - "FAIR PROGRESSION"
                       0.25 - 0.36 - "GOOD PROGRESSION"
                       0.37 - 1.00 - "GREAT PROGRESSION"

        ATTAINABLITIY 1.00 - 0.99 - "INCREASE MIN THRU PHASE"
                      0.99 - 0.70 - "FINE-TUNING NEEDED"
                      0.69 - 0.00 - "MAJOR CHANGES NEEDED"
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(INT.SUMY)
            TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-87      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  JUL 88

                 **** INTERSECTION PERFORMANCE SUMMARY ****

        CYCLE LENGTH =  70 SECS         SYSTEM MAXIMIN CYCLE =  95 SECS
```

INT NO	CROSS STREET INTERSECTION	PHASE ART	PHASE CRS	MIN. DELAY CYCLE (SECS)	INTERSECTION V/C RATIO	AVERAGE DELAY (SECS/VEH)	INT NO
1	INDUSTRIAL	2	2	47	.75	6.2	1
2	TROLLEY STAT	1	2	49	.63	5.5	2
3	BROADWAY	1	1	95	1.02	22.4	3
4	orange	4	2	51	.54	5.4	4

```
  NOTE: PHASE SEQUENCE CODE FOR ARTERIAL (ART)  CROSS STREET (CRS)
       ---------------------------------------------------------------
       1 - LEFT TURN FIRST OR DUAL LEFTS LEADING   OR DUAL LEFTS (1+5)
       2 - THROUGH FIRST   OR DUAL THRUS LEADING   OR DUAL THRUS (2+6)
       3 - LEADING GREEN   OR NO. 5 LEADING        OR LT 5 LEADS (2+5)
       4 - LAGGING GREEN   OR NO. 1 LEADING        OR LT 1 LEADS (1+6)
```

(ART.MOE)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-87 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 JUL 88

**** TOTAL ARTERIAL SYSTEM PERFORMANCE ****

CHULA VISTA PALOMAR ST. DISTRICT 01/14/91 RUN NO. 2

CYCLE LENGTH = 70 SECS BAND A = 25 SECS BAND B = 17 SECS

AVERAGE PROGRESSION SPEED - BAND A = 40 MPH BAND B = 40 MPH

.30 EFFICIENCY 1.00 ATTAINABILITY

AVERAGE INTERSECTION DELAY	TOTAL SYSTEM DELAY	TOTAL NUMBER VEHICLES
11.7 SECS/VEH	40.3 VEH-HR/HR	12426.
TOTAL SYSTEM FUEL CONSUMPTION	TOTAL SYSTEM STOPS	MAXIMIN CYCLE
105.17 GAL/HR	7752. STOPS	95 SECS

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(ART.SUMY)
           TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-87      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  JUL 88

           **** PASSER-87 BEST PROGRESSION SOLUTION SUMMARY ****
 CHULA VISTA                PALOMAR ST.     DISTRICT    01/14/91     RUN NO.   3

        CYCLE LENGTH  = 95 SECS      (MAXIMIN CYCLE  =102 SECS)
        EFFICIENCY    =   .22        (FAIR PROGRESSION)
        ATTAINABILITY =   .79        (FINE-TUNING NEEDED)

        BAND A        = 23 SECS      AVERAGE SPEED  =  38 MPH
        BAND B        = 18 SECS      AVERAGE SPEED  =  38 MPH

   NOTE: ARTERIAL PROGRESSION EVALUATION CRITERIA
         -----------------------------------------------
        EFFICIENCY     0.00 - 0.12 - "POOR PROGRESSION"
                       0.13 - 0.24 - "FAIR PROGRESSION"
                       0.25 - 0.36 - "GOOD PROGRESSION"
                       0.37 - 1.00 - "GREAT PROGRESSION"

        ATTAINABLITIY 1.00 - 0.99 - "INCREASE MIN THRU PHASE"
                       0.99 - 0.70 - "FINE-TUNING NEEDED"
                       0.69 - 0.00 - "MAJOR CHANGES NEEDED"
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(INT.SUMY)
           TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-87      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  JUL 88

                **** INTERSECTION PERFORMANCE SUMMARY ****

        CYCLE LENGTH =  95 SECS        SYSTEM MAXIMIN CYCLE = 102 SECS

   INT   CROSS STREET  PHASE   MIN. DELAY  INTERSECTION  AVERAGE DELAY  INT
    NO   INTERSECTION  ART CRS CYCLE (SECS)  V/C RATIO    (SECS/VEH)     NO
   ---------------------------------------------------------------------------

    1     INDUSTRIAL    2   2       55          .81          10.6         1
    2   TROLLEY STAT    1   2      102          .99          22.6         2
    3       BROADWAY    1   1       78          .97          32.9         3
    4         ORANGE    4   2       50          .54           7.5         4

   NOTE: PHASE SEQUENCE CODE FOR ARTERIAL (ART)  CROSS STREET (CRS)
         ---------------------------------------------------------------
        1 - LEFT TURN FIRST OR DUAL LEFTS LEADING    OR DUAL LEFTS (1+5)
        2 - THROUGH FIRST   OR DUAL THRUS LEADING    OR DUAL THRUS (2+6)
        3 - LEADING GREEN   OR NO. 5 LEADING         OR LT 5 LEADS (2+5)
        4 - LAGGING GREEN   OR NO. 1 LEADING         OR LT 1 LEADS (1+6)
```

(ART.MOE)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-87 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 JUL 88

**** TOTAL ARTERIAL SYSTEM PERFORMANCE ****

CHULA VISTA PALOMAR ST. DISTRICT 01/14/91 RUN NO. 3

CYCLE LENGTH = 95 SECS BAND A = 23 SECS BAND B = 18 SECS
AVERAGE PROGRESSION SPEED - BAND A = 38 MPH BAND B = 38 MPH

.22 EFFICIENCY .79 ATTAINABILITY

AVERAGE INTERSECTION DELAY	TOTAL SYSTEM DELAY	TOTAL NUMBER VEHICLES
20.9 SECS/VEH	83.3 VEH-HR/HR	14314.

TOTAL SYSTEM FUEL CONSUMPTION	TOTAL SYSTEM STOPS	MAXIMIN CYCLE
129.81 GAL/HR	10514. STOPS	102 SECS

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(ART.SUMY)
          TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-87      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  JUL 88

          **** PASSER-87 BEST PROGRESSION SOLUTION SUMMARY ****
 CHULA VISTA                PALOMAR ST.     DISTRICT    01/14/91     RUN NO.   4

       CYCLE LENGTH  = 75 SECS       (MAXIMIN CYCLE  = 69 SECS)
       EFFICIENCY    =   .14         (FAIR PROGRESSION)
       ATTAINABILITY =   .50         (MAJOR CHANGE REQ'D)

       BAND A        = 11 SECS       AVERAGE SPEED  =  38 MPH
       BAND B        =  9 SECS       AVERAGE SPEED  =  38 MPH

   NOTE: ARTERIAL PROGRESSION EVALUATION CRITERIA
       ----------------------------------------------
       EFFICIENCY     0.00 - 0.12 - "POOR PROGRESSION"
                      0.13 - 0.24 - "FAIR PROGRESSION"
                      0.25 - 0.36 - "GOOD PROGRESSION"
                      0.37 - 1.00 - "GREAT PROGRESSION"

       ATTAINABLITIY 1.00 - 0.99 - "INCREASE MIN THRU PHASE"
                      0.99 - 0.70 - "FINE-TUNING NEEDED"
                      0.69 - 0.00 - "MAJOR CHANGES NEEDED"


(INT.SUMY)
          TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-87      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  JUL 88

               **** INTERSECTION PERFORMANCE SUMMARY ****

       CYCLE LENGTH =  75 SECS         SYSTEM MAXIMIN CYCLE =  69 SECS
```

INT NO	CROSS STREET INTERSECTION	PHASE ART	PHASE CRS	MIN. CYCLE	DELAY (SECS)	INTERSECTION V/C RATIO	AVERAGE DELAY (SECS/VEH)	INT NO
1	INDUSTRIAL	2	2	39		.66	6.9	1
2	TROLLEY STAT	1	2	45		.66	10.9	2
3	MAIN ENTRANC	1	1	66		.64	16.6	3
4	BROADWAY	1	1	69		.88	18.7	4
5	ORANGE	4	2	50		.56	5.6	5

```
   NOTE: PHASE SEQUENCE CODE FOR ARTERIAL (ART)  CROSS STREET (CRS)
       ---------------------------------------------------------------
       1 - LEFT TURN FIRST OR DUAL LEFTS LEADING    OR DUAL LEFTS (1+5)
       2 - THROUGH FIRST   OR DUAL THRUS LEADING    OR DUAL THRUS (2+6)
       3 - LEADING GREEN   OR NO. 5 LEADING         OR LT 5 LEADS (2+5)
       4 - LAGGING GREEN   OR NO. 1 LEADING         OR LT 1 LEADS (1+6)
```

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(ART.MOE)
          TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
PASSER II-87      MULTIPHASE ARTERIAL PROGRESSION - 145101     VER 1.0  JUL 88

                **** TOTAL ARTERIAL SYSTEM PERFORMANCE ****

 CHULA VISTA                PALOMAR ST.     DISTRICT    01/14/91     RUN NO.   4

        CYCLE LENGTH =  75 SECS       BAND A =  11 SECS    BAND B =   9 SECS
        AVERAGE PROGRESSION SPEED -  BAND A =  38 MPH     BAND B =  38 MPH

                     .14 EFFICIENCY    .50 ATTAINABILITY

  AVERAGE INTERSECTION DELAY      TOTAL SYSTEM DELAY      TOTAL NUMBER VEHICLES
         12.8 SECS/VEH              63.1 VEH-HR/HR              17713.

  TOTAL SYSTEM FUEL CONSUMPTION    TOTAL SYSTEM STOPS    MAXIMIN CYCLE
         127.08 GAL/HR              12381. STOPS               69 SECS
```

(ART.SUMY)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-87 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 JUL 88

**** PASSER-87 BEST PROGRESSION SOLUTION SUMMARY ****

CHULA VISTA PALOMAR ST. DISTRICT 01/14/91 RUN NO. 5

CYCLE LENGTH	= 65 SECS	(MAXIMIN CYCLE = 82 SECS)
EFFICIENCY	= .28	(GOOD PROGRESSION)
ATTAINABILITY	= 1.00	(INCREASE MIN. THROUGH PHASE)
BAND A	= 17 SECS	AVERAGE SPEED = 40 MPH
BAND B	= 18 SECS	AVERAGE SPEED = 40 MPH

NOTE: ARTERIAL PROGRESSION EVALUATION CRITERIA

EFFICIENCY	0.00 - 0.12	"POOR PROGRESSION"
	0.13 - 0.24	"FAIR PROGRESSION"
	0.25 - 0.36	"GOOD PROGRESSION"
	0.37 - 1.00	"GREAT PROGRESSION"
ATTAINABLITIY	1.00 - 0.99	"INCREASE MIN THRU PHASE"
	0.99 - 0.70	"FINE-TUNING NEEDED"
	0.69 - 0.00	"MAJOR CHANGES NEEDED"

(INT.SUMY)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-87 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 JUL 88

**** INTERSECTION PERFORMANCE SUMMARY ****

CYCLE LENGTH = 65 SECS SYSTEM MAXIMIN CYCLE = 82 SECS

INT NO	CROSS STREET INTERSECTION	PHASE ART	PHASE CRS	MIN. DELAY CYCLE (SECS)	INTERSECTION V/C RATIO	AVERAGE DELAY (SECS/VEH)	INT NO
1	INDUSTRIAL	2	2	39	.66	6.4	1
2	MINOR ENT.	4	3	60	.86	12.6	2
3	BROADWAY	1	1	82	.98	20.3	3
4	ORANGE	4	2	51	.56	5.3	4

NOTE: PHASE SEQUENCE CODE FOR ARTERIAL (ART) CROSS STREET (CRS)

1 - LEFT TURN FIRST	OR DUAL LEFTS LEADING	OR DUAL LEFTS (1+5)
2 - THROUGH FIRST	OR DUAL THRUS LEADING	OR DUAL THRUS (2+6)
3 - LEADING GREEN	OR NO. 5 LEADING	OR LT 5 LEADS (2+5)
4 - LAGGING GREEN	OR NO. 1 LEADING	OR LT 1 LEADS (1+6)

(ART.MOE)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-87 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 JUL 88

**** TOTAL ARTERIAL SYSTEM PERFORMANCE ****

CHULA VISTA PALOMAR ST. DISTRICT 01/14/91 RUN NO. 5

CYCLE LENGTH = 65 SECS BAND A = 17 SECS BAND B = 18 SECS
AVERAGE PROGRESSION SPEED - BAND A = 40 MPH BAND B = 40 MPH

.28 EFFICIENCY 1.00 ATTAINABILITY

AVERAGE INTERSECTION DELAY	TOTAL SYSTEM DELAY	TOTAL NUMBER VEHICLES
12.6 SECS/VEH	50.7 VEH-HR/HR	14538.

TOTAL SYSTEM FUEL CONSUMPTION	TOTAL SYSTEM STOPS	MAXIMIN CYCLE
125.20 GAL/HR	10279. STOPS	82 SECS

(ART.MOE)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

PASSER II-87 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0 JUL 88

**** TOTAL ARTERIAL SYSTEM PERFORMANCE ****

CHULA VISTA PALOMAR ST. DISTRICT 01/14/91 RUN NO. 6

CYCLE LENGTH = 80 SECS BAND A = 12 SECS BAND B = 9 SECS
AVERAGE PROGRESSION SPEED - BAND A = 42 MPH BAND B = 42 MPH

.14 EFFICIENCY .49 ATTAINABILITY

AVERAGE INTERSECTION DELAY	TOTAL SYSTEM DELAY	TOTAL NUMBER VEHICLES
15.8 SECS/VEH	64.1 VEH-HR/HR	14630.
TOTAL SYSTEM FUEL CONSUMPTION	**TOTAL SYSTEM STOPS**	**MAXIMIN CYCLE**
131.14 GAL/HR	11099. STOPS	73 SECS

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AN ANALYSIS OF ECONOMIC IMPACT RESULTING FROM DEVELOPMENT OF PALOMAR TROLLEY CENTER

Presented to the
CITY OF CHULA VISTA

Presented by
ECONOMICS RESEARCH ASSOCIATES

AUGUST 1991

ERA PROJECT NO. 10080

10990 Wilshire Boulevard, Suite 1600, Los Angeles, California 90024
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GENERAL LIMITING CONDITIONS

Every reasonable effort has been made to ensure that the data contained in this study reflect the most accurate and timely information possible, and they are believed to be reliable. This study is based on estimates, assumptions and other information developed by Economics Research Associates from its independent research effort, general knowledge of the industry and consultations with the client and the client's representatives. No responsibility is assumed for inaccuracies in reporting by the client, the client's agent and representatives or any other data source used in preparing or presenting this study.

This report is based on information that was current as of January 1991. Economics Research Associates undertook an update of certain shopping center data in March 1991. No update has occurred since such date.

No warranty or representation is made by Economics Research Associates that any of the projected values or results contained in this study will actually be achieved.

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This study is qualified in its entirety by, and should be considered in light of, these limitations, conditions and considerations.

LIST OF TABLES

Section I

INTRODUCTION

A 198,200-square-foot shopping center has been proposed on an 18.20-acre site adjacent to the Palomar Trolley Station in Chula Vista. Figure I-1 presents the site's location on Palomar Street.

As proposed, the project will be a 198,200-square-foot "regional draw center," containing anchor outlets that typically have a regional market area and generate high retail sales per square foot. Example anchor tenant types include Nordstrom's Rack, Walmart, Marshall's, Ross, Office Club, Circuit City, Sportsmart, Mega-Foods or others. The project will have five pads on which at least two fast-food restaurants will locate. Community and regional serving tenants, who generate $150 in gross taxable sales per square foot per year, are planned to occupy 65 percent of the total leasable area, or almost 129,000 square feet. The other 35 percent of space, or 69,000 square feet, are planned to include tenants which may generate lower taxable sales. Public amenities may include a linear park, a bicycle path, a pedestrian linkage to the trolley station, a traffic circulation link and loop, and an on-site or off-site day care center. The site is within the City of Chula Vista's Southwest Redevelopment Project Area which was adopted in the fall of 1990, and the Montgomery Specific Plan area.

The purpose of this study is to analyze the potential market impact of the proposed project, specifically the proposed project's impact upon existing commercial centers and districts in the community and neighborhood.

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LIST OF FIGURES

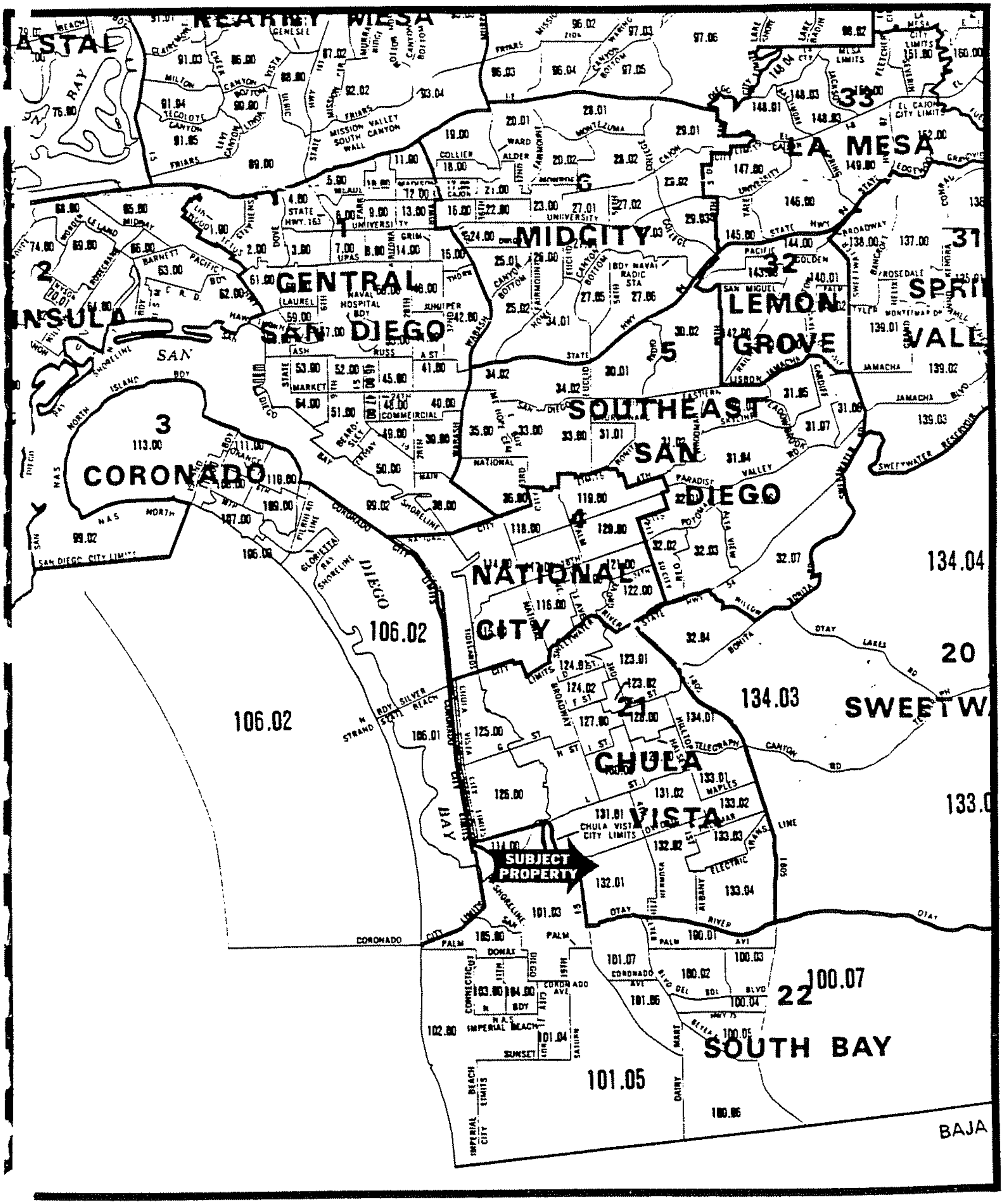


Figure I-1

SITE LOCATION

Section II

EXECUTIVE SUMMARY

This section presents the report's summary findings. Please refer to the following sections for a more thorough discussion of issues and assumptions.

MARKET DEMOGRAPHIC PROFILE

The market population on the neighborhood and community level is stable, with little population growth projected. The regional market population, however, which includes the eastern portions of Chula Vista, is projected to grow at a significant rate. Approximately 35,700 people live in the 1.5-mile neighborhood market area, 158,700 people live in the 3.0-mile community market area, and 256,300 people live in the 5.0-mile regional market area.

The market area population is a family-oriented, moderate-income community. As the market area becomes larger, the proportion of families and higher income households increases. Average incomes on the regional level should increase as the new eastern Chula Vista communities develop.

COMPETITIVE ENVIRONMENT

Vacancies are low in neighborhood- and community-serving shopping centers. The vacancy rate among selected planned shopping centers surveyed (excluding freestanding strip retail space) in the neighborhood market area during March 1991 was 2.2 percent. The vacancy rate among selected shopping centers surveyed in the community market area was 6.3 percent among all centers and 5.0 percent among community or regional shopping centers. Most of the vacancy among community and regional shopping centers was at Chula Vista Center which is still leasing new space added during its recent renovation. A 5.0 percent vacancy rate normally reflects healthy retail market conditions.

There is an estimated 1,931,000 square feet of total retail space in the neighborhood market area, including freestanding retail space not located in shopping centers and community- or regional-serving centers, with an overall vacancy rate of 3.2 percent. Of this amount, an estimated 988,000 occupied square feet is primarily supported by the neighborhood population, rather than the community or regional population, or local work force. Roughly 5.9 percent of the neighborhood supported space was vacant when surveyed in December 1990. Approximately 60,000 additional square feet was under construction and planned as of March 1991.

The market is relatively competitive, especially at the neighborhood level. The subject site will be competitive due to its visibility and access. The market appears to support most of the existing space, and there is capacity to absorb more retail space oriented to certain markets. Since the neighborhood population base is not expanding, however, market support appears to result from shopping centers expanding their market areas beyond the neighborhood.

ESTIMATED IMPACTS

It is our opinion that the portion of the proposed Palomar Trolley Center that is community and regional serving could be supported without adversely affecting the community market area. This is not to say that new community and regional-serving outlets will not compete with other stores in the market area. Competition would be expected; however, we believe there is sufficient market population and growth to support more competitors. Consumers will benefit from increased shopping alternatives.

However, we believe portions of the proposed project which are neighborhood-serving could be redundant in the neighborhood market area and could have a negative impact that might result in an increase in the neighborhood-serving space vacancy rate or lower supportable rents in older neighborhood-oriented shopping centers. The extent of this negative impact depends on the amount and types of neighborhood-serving space introduced.

If all of the shopping center space comprising the 35 percent share not devoted to high taxable sales uses is neighborhood oriented, we believe there will be an adverse impact on the neighborhood-oriented retail centers.

Introducing 82,300 more square feet of new neighborhood space into the market area that already has 988,000 square feet of neighborhood-supported space, of which an additional 62,000 square feet or 5.9 percent of the total 1,050,000 square feet is already vacant, could potentially increase the current neighborhood-serving vacancy rate to almost 13.1 percent or higher depending on the types of neighborhood-serving outlets leasing space in the proposed center and how much planned and proposed space in the market area is preleased. Most of this vacancy would probably occur in the older retail centers and freestanding retail space rather than in the newer retail centers, which have experienced generally low vacancy rates. A likely alternative impact is lower supportable rents among some outlets and centers.

Some absorption may occur between now and August 1993, when the proposed center is expected to open, that could reduce this impact. However, additional absorption during the interim would only occur if the neighborhood market population grows (which it is not expected to do), existing older retail space and outlets leave the market, existing neighborhood retailers expand their market draw to include community and regional populations, or new retailers targeting community and regional populations, or new retailers targeting community and regional populations move into the vacant space or replace existing neighborhood-oriented retailers.

If the proportion of the project devoted to lower taxable sales uses were instead to target the broader community or regional market population, serve customers drawn to the community- and regional-serving anchors located elsewhere in the project, or target certain types of neighborhood-serving outlets, the negative impacts to other neighborhood shopping centers would be less.

Possible Mitigation Measures

The existing Semi-Exclusive Negotiating Agreement with Pacific Scene, Inc., for Commercial Shopping Center at South Side of Palomar Between Industrial and Broadway, Section V., A., 7., stipulates that the "Disposition and Development Agreement" (DDA), include a clause that restricts the developer from leasing or selling to tenants or purchasers greater than 15,000 square feet of net usable floor area until the Executive Director of the Redevelopment Agency of the City of Chula Vista has approved the tenant. Approval can be withheld if the Agency finds and reasonably determines, at a public meeting and after notice is provided to the developer, "that the proposed tenant or purchaser is incompatible with the commercial mixture of tenants present in the market area of the Project." This provision in the future DDA, if applied effectively by the Agency to protect over-building of neighborhood-oriented uses in the neighborhood market area, can mitigate the project's potential negative impact.

Despite this mitigation measure, as new centers are developed over time, the older obsolete centers will have difficulty competing, even if the market is not over-built. This competition may force older centers to upgrade to compete, but only if rents and occupancies can be sustained at levels to amortize the improvement costs.

Overall, the proposed project concept, with its regional-serving anchors, will have less impact than a similar size center that is strictly neighborhood oriented. Despite its potential impact on neighborhood retailers, it should generate a net fiscal surplus to the city since its anchors will draw customers and taxable sales from outside Chula Vista.

Section III

MARKET DEMOGRAPHIC PROFILE

This section describes the existing and projected demographic profile of the market area population.

MARKET AREA DEFINITION

Since the purpose of this study is to evaluate the economic impact of the Palomar Trolley Center development on the local community although the project's major anchor tenants will be regional serving, we must analyze population and competition in terms of competitive market areas.

In general, the market area expands as the product sold is purchased less frequently or becomes more expensive. Items and services purchased on a weekly basis, such as groceries, pharmaceuticals, and personal services are often found in neighborhood shopping centers which serve the population within approximately 1.5 miles of the center. A community shopping center may include neighborhood shopping center elements, such as food and services, but usually includes other tenants that sell items purchased often but not weekly. These other tenants found in a community shopping center may include discount general merchandise outlets, hardware stores, toy stores, some clothing stores, restaurants, etc. A regional shopping center sells items purchased even less frequently, such as fashion clothing, furniture, appliances, specialty items, etc.

While these distinctions were once fairly clear, in recent years some crossover has occurred. Certain specialty stores are seen in all three types of centers. Certain anchor tenants traditionally found in community shopping centers are now large and powerful enough to draw from a regional market. Agglomerations of traditional community shopping centers now offer such diversity that they have the drawing power of traditional regional shopping centers. The Sports Arena area in San Diego is an example of this agglomeration.

While larger anchor tenants tend to reach a broader market area than smaller tenants, a retailer's market orientation is more important than its size. Small and medium-size outlets such as certain hobby stores, wallpaper and paint stores, travel agencies and restaurants, for example, serve more than just the neighborhood market area.

Most personal services—such as laundromats, dry cleaners, and hair stylists—ordinary grocery stores, and small gift shops primarily serve the neighborhood population. However, small stores that normally sell to the neighborhood population, such as an ice cream shop, postal annex, or fast-food restaurant, for example, may instead target and serve a community or regional population if located in a center with community or regional-serving anchor outlets.

Table III-1 presents the reported market areas for possible anchor tenants proposed for Palomar Trolley Center. As shown, the reported market areas range from 3- to 10-mile radius, and most report a market area radius of 5 miles. For our analysis here, we are defining the neighborhood market area as 1.5 miles from the subject site, the community market area as 3.0 miles from the subject site, and the regional market area as 5.0 miles from the subject site. We have also counted the population within 7.0 miles from the subject site, which would include the primary and secondary market on a regional level; however, the population living between 5.0 and 7.0 miles of the subject site are as close or closer to power centers and regional centers in the Sports Arena area, College Grove Center, Mission Valley, Horton Plaza, and Plaza Bonita, so are not considered a prime source of demand. Figure III-1 presents the geographic areas covered by the various market areas.

POPULATION

According to the San Diego Association of Governments (SANDAG) Series 7 population projections, there are approximately 35,700 people within 1.5 miles, almost 158,700 people within 3.0 miles, over 256,300 people within 5.0 miles, and over 474,800 people within 7.0 miles of the Palomar Trolley Center site, (excluding Tijuana),

Table III-1

MARKET AREAS FOR SELECTED ANCHOR RETAILERS

Retailer	Market Area (miles)
Home Depot	5.0
Nordstrom's Rack*	5.0
Walmart	n.a.
Marshall's	5.0
Ross	3.5
Office Club	5.0
Circuit City	10.0
Sportsmart	5.0

*Based on Nordstrom's market area.
n.a. means not available.

Source: Lease Trac.

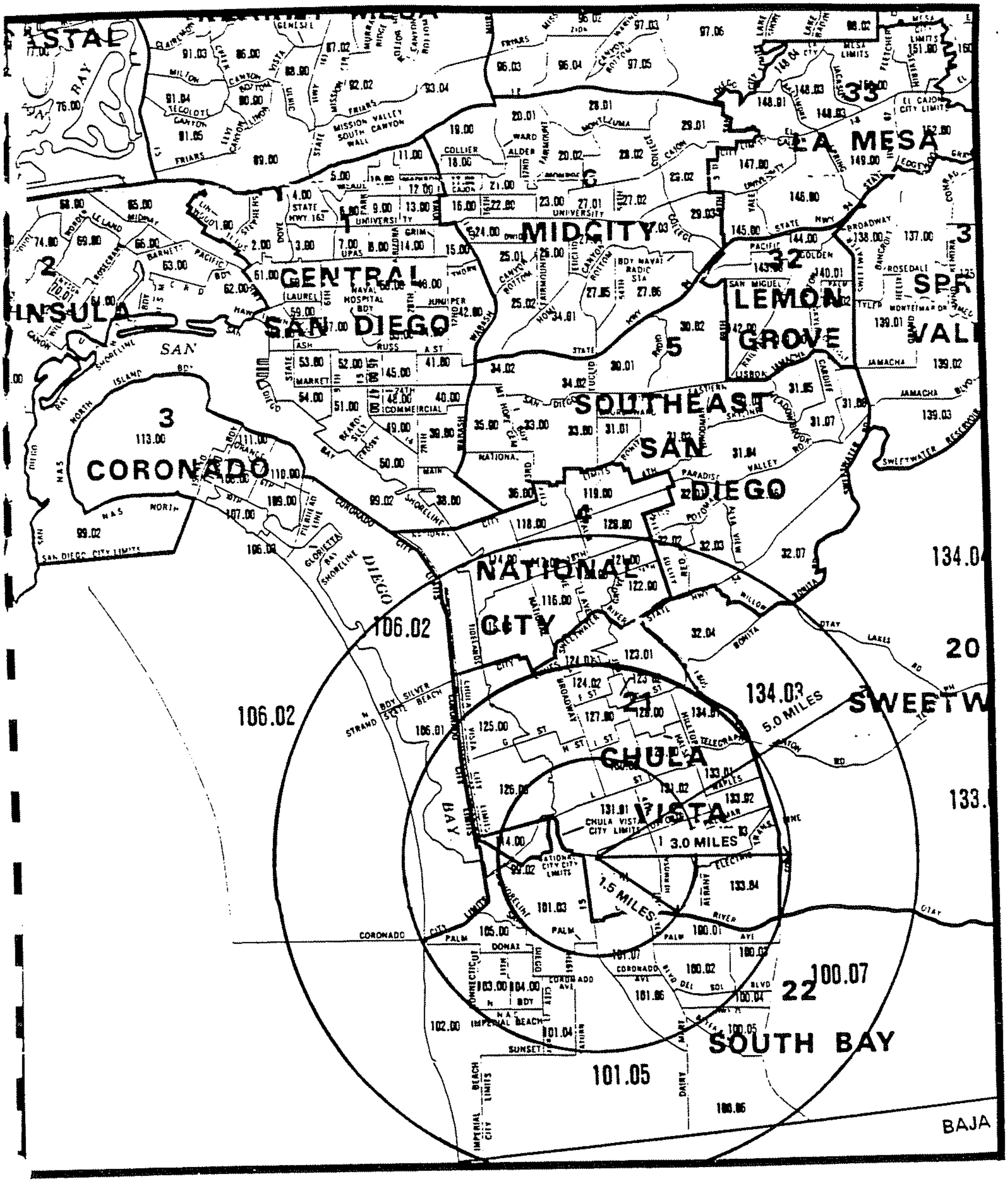


Figure III-1
MARKET AREAS

as shown in Table III-2. The regional population within 5.0 miles constitutes approximately 11 percent of the County of San Diego population.

SANDAG's Series 7 projections are based on the general plans and zoning regulations in place at the time the projections were made. SANDAG's projections indicate that the neighborhood market area of 1.5 miles is primarily built-out and stable, showing slight population loss during the next decade. The 3.0-mile community market area also is stable, with modest population growth projected. The regional market areas of 5.0 and 7.0 miles, which include portions of the newly developing eastern Chula Vista, are projected to grow at 1.2 to 1.3 percent per year, which is somewhat slower than the projected population growth rate countywide, but is still a significant growth rate, especially for the outer portions of the regional market area.

These projections describe a stable, mostly built-out neighborhood and community market core and a growing regional fringe. We consider these projections conservative in the long term since they do not take into account possible zoning changes resulting from the city's redevelopment efforts on the community level and the future new town of Otay Ranch at the regional level. For the near term, however, these projections are reasonable.

AGE DISTRIBUTION

Compared to the countywide age distribution, all of the market areas have a greater proportion of children and middle-age adults, but a lower proportion of young adults. While the 3.0-mile and 5.0-mile populations have a lower than average share of seniors, the immediate 1.5-mile market area has a higher percentage of seniors, as shown in Table III-3.

In the near- to mid-term, this age distribution profile reflects a strong family-oriented market where discount retailing, household items, and family restaurants and entertainment will probably do well.

Table III-2

CURRENT AND PROJECTED POPULATION AROUND PROJECT SITE

Market Area	1990	1995	2000	Annual Rate of Change 1990-2000
1.5 Miles	35,701	34,995	34,892	(0.2%)
3.0 Miles	158,661	158,838	164,681	0.4%
5.0 Miles	256,309	266,161	288,129	1.2%
7.0 Miles	474,840	496,867	537,654	1.3%
San Diego County	2,358,350	2,567,193	2,765,421	1.6%

Source: San Diego Association of Governments and Sourcepoint; and Economics Research Associates.

Table III-3

ESTIMATED MARKET AREA AGE DISTRIBUTIONS

Market Area	0-17	18-24	25-34	35-59	60-64	65+	Median Age
1.5 Miles							
Percent	27.4%	13.2%	14.6%	27.5%	5.1%	12.2%	31.7
3.0 Miles							
Percent	31.0%	12.2%	14.7%	29.6%	3.8%	8.7%	30.0
5.0 Miles							
Percent	30.0%	14.2%	15.2%	28.6%	4.0%	8.0%	29.5
Countywide							
Percent	25.5%	16.9%	18.3%	24.9%	4.1%	10.3%	31.2

Source: San Diego Association of Governments and Sourcepoint; and Economics Research Associates.

HOUSEHOLDS

Although total population within 1.5 and 3.0 miles of the subject site is relatively stable, the number of households is projected to grow slightly in both areas during the next decade; this growth will still be well below the regional market and countywide growth, as shown in Table III-4. The number of households can grow even though the population is stable if the average household size is decreasing. The average household size will decrease as children become adults and move out on their own or as married couples divorce, for example. As shown in Table III-4, the average household size is projected to decrease in each market area during the next decade.

The current average household size is largest in the community 3.0-mile market area and smallest in the immediate 1.5-mile market area, indicating that families are most prominent in the outside fringe of the community market area. The neighborhood 1.5-mile market area has the smallest households, even smaller than the average household size countywide. This may reflect the relatively high proportion of seniors in this market area. The community 3.0-mile market area, however, has significantly larger households on average, and the regional market area also has larger average households. Both in terms of household growth and household size, the community and regional market areas show the most potential.

HOUSEHOLD INCOME

Each of the market areas has lower average household incomes than San Diego County as a whole; however, income distribution in each market area differs, as shown in Table III-5.

The neighborhood 1.5-mile market area has the lowest incomes of the three market areas, with a 1987 median household income of approximately $24,200, which is roughly equivalent to $28,300 in 1991 dollars. This market area has a much higher proportion of households in the low and moderate income categories, and a much lower proportion of households in the high income categories when compared to the countywide distribution. In 1987, 54 percent of all households in the 1.5-mile market area had incomes that were less than $25,000, compared to 42 percent countywide.

Table III-4

CURRENT AND PROJECTED MARKET AREA HOUSEHOLDS

Market Area	1990	1995	2000	Annual Growth Rate 1990-2000
1.5 Miles				
Total	14,485	14,610	14,848	0.2%
Average Size	2.46	2.40	2.35	
3.0 Miles				
Total	54,849	56,718	59,603	0.8%
Average Size	2.89	2.80	2.76	
5.0 Miles				
Total	97,024	106,713	120,128	2.2%
Average Size	2.64	2.49	2.40	
Countywide				
Total	861,633	958,023	1,051,006	2.0%
Average Size	2.73	2.68	2.63	

Source: San Diego Association of Governments and Sourcepoint; and Economics Research Associates.

Table III-5

ESTIMATED MARKET AREA HOUSEHOLD INCOME DISTRIBUTIONS
(In 1987 Dollars)

Market Area	$0-9,999	$10,000-14,999	$15,000-24,999	$25,000-34,999	$35,000-49,999	$50,000 and Up	Total/Percent Households	Median Income[1]
1.5 Miles Percent	13%	13%	28%	20%	16%	10%	100%	$24,214
3.0 Miles Percent	11%	11%	24%	20%	19%	15%	100%	$27,446
5.0 Miles Percent	12%	11%	23%	19%	18%	17%	100%	$28,486
Countywide Percent	11%	10%	21%	18%	19%	22%	100%	$29,755

[1] Weighted average of median incomes reported for respective census tracts.

Source: San Diego Association of Governments and Sourcepoint; and Economics Research Associates.

The community 3.0-mile market area had a median household income of $27,500 in 1987, approximately equivalent to $32,100 in 1991. Income in this market area is higher than the neighborhood market area, but less than the regional market area or countywide incomes. The community market area's income distribution, unlike the neighborhood market area, is concentrated in the middle-income categories. The community market area has approximately the same distribution of households earning less than $15,000 in 1987 as did the county as a whole, but a much lower percentage of households earning more than $50,000. Approximately 44 percent of the households in the 3.0-mile market area earned between $15,000 and $35,000 annually, compared to 39 percent countywide.

The regional 5.0-mile market area had a 1987 median household income of $28,500, or equivalent to $33,300 in 1991. This was the highest income market area, although the median household income was still below the countywide median income figure of $29,800 in 1987 (or $34,800 in 1991). The regional market area had a slightly greater proportion of households in each low and moderate income category than did the county as a whole, but had a much lower percentage of households earning more than $50,000 per year. The regional market could be characterized as a moderate-income market.

The income characteristics of the market area population, in particular the regional market area population, are expected to change over the next decade as the higher-income communities in eastern Chula Vista, such as Eastlake, Sunbow, and in the future, Otay Ranch, are developed. These developments should increase the overall average income level of the regional market area in the long term.

Section IV

COMPETITIVE ENVIRONMENT

This section describes the competitive retail environment in which Palomar Trolley Center development would occur.

MAJOR SHOPPING CENTERS AND DISTRICTS

Several different shopping centers and districts exist in the market area. As shown in Table IV-1, these selected retail centers range from small convenience center "mini-malls" anchored by 24-hour food stores, to expansive "regional" shopping malls anchored by national and chain department stores.

The following describes selected neighborhood, community and regional shopping centers in the 1.5-mile, 3.0-mile and 5.0-mile market areas.

1.5-Mile Radius Market

Table IV-1 presents selected shopping centers within 1.5 miles of the subject site. This is a sample of centers and does not include every center in the market area. While a few of the smaller centers have very high vacancy rates, the overall vacancy rate among the centers surveyed was approximately 2.2 percent, which is considered a low rate. In general, a 5 percent vacancy rate reflects healthy market conditions. These vacancies rates were based on conversations with respective leasing agents and a site review conducted in March 1991. Eight of the eleven centers surveyed are more than five years old, with five over 15 years old. The following are the largest centers.

> **Price Club Center** -- Located at 1144 Broadway, less than three blocks north of the project site, this regional serving shopping center is anchored by a Price Club membership store, Price Bazaar, Levitz, and Home Club. Built in 1982, this center has an "off price" marketing focus that attracts the bargain-hunting shopper. There is an available food court for those who are hungry for a fast meal.

Table IV-1

SELECT RETAIL CENTERS
1990
(1.5-Mile Radius at Site)

Name/Location	Anchors	Age	Estimated Square Feet	Vacancy
Country Club Shopping Center 870 Third Avenue	Long's Drugs Von's	21	56,000	0%
Big Bear Center 1340 Third Avenue	Big Bear Builders Emporium	10	100,000	0
Florence Shopping Center 1034-1056 Third Avenue	Car Quest Auto Parts Mr. T's Bottle Shop	21	26,000	0
K-Mart Third Avenue	K-Mart McMahan's Furniture	n.a.	100,000 30,000	0
Oxford Center Third & Oxford	Radio Shack Chula Vista Office Supply Pacific Commerce Bank	17	44,000	0
Oxford Park Plaza 1215 Broadway	Krause's Sofa Factory	7	18,500	54
Palomar Square Palomar Avenue & Broadway	Jack 'N The Box Blockbuster Video Kentucky Fried Chicken	5	27,200	20
Price Bazaar 1144 Broadway	Price Bazaar Price Club Home Club Levitz	9	368,000	0
Sommerset Plaza East and West Broadway between Main Street and Anita Street	Big O Tires Family Fitness Center Salvation Army Tile Club	2	110,000	5
Target Center Broadway & Palomar	Target Ralphs Pic 'N' Save Dow Stereo	20	120,000	0
Palm City Plaza Palm & Hollister	7-11	--	8,000	12

urce: *Shopping Center Directory* and respective brokers, January and March 1991.

Sommerset Plaza East & West -- Located in the 1600 block of Broadway, about three blocks south of the project site, this community shopping center is anchored by an automobile tire store, a fitness center, a tile store, and a Salvation Army office.

Target Center -- Located at the northwest corner of Palomar and Broadway, the 20-year old community center was renovated to add Target, Ralph's, Dow Stereo, in addition to Pic 'N' Save. This center is an example of a project which mixes community-serving tenants and neighborhood-serving tenants.

K-Mart -- Located on 1030 3rd Avenue, southeast of the project site, this 100,400-square-foot K-Mart is a large freestanding discount general merchandise store which serves a community to regional market area.

1.5- to 3.0-Mile Radius Market

Table IV-2 presents selected centers between 1.5 and 3.0 miles of the project site. More than half of the centers surveyed in this group are over ten years old. Reported vacancies are at 6.3 percent among the centers reporting vacancy rates. Among the three larger community and regional shopping centers, the vacancy rate is lower, at 5.0 percent. Again, a 5.0 vacancy rate usually reflects a healthy retail market. Below are descriptions of the largest centers.

Southland Plaza Shopping Center -- Located on the northeast corner of Palm Avenue and Saturn Boulevard, just outside the 1.5-mile market area, this small regional serving shopping center is anchored by a department store, a chain apparel store, a restaurant, a grocery store, and a drug store. First built in 1981, the center was expanded in 1987 to accommodate additional retail outlets.

Canyon Plaza -- Located at 505 Telegraph Canyon Road, this neighborhood shopping center is anchored by a grocery store and a drug store. It is immediately accessible from Interstate 805 which allows it to draw customers from outside its typical market area.

Table IV-2

SELECT RETAIL CENTERS
1990
(1.5 to 3.0 Miles from Site)

Name/Location	Anchors	Age	Estimated Square Feet	Vacancy
Broadway Village 200 Broadway	Video Store Clothestime	12	11,750	19%
Canyon Plaza Telegraph Canyon Road and Halecrest Drive	Thrifty's Von's	12	89,100	0
Chula Vista Center "H" Street & Broadway	Broadway J.C. Penney Sears	31 (rehabilitated in 1988)	823,000	6
Chula Vista Square 542 Broadway	Nurseryland	25 (rehabilitated in 1990)	32,000	50
Terra Nova Plaza E. "H" Street and I-805	Big 5 Home Depot Long's Drugs Marshall's Von's	5	297,000	1
Woodside Plaza 4360-4380 Otay Valley Road	Liquor Store	12	40,000	3
Imperial Beach Plaza Palm and 13th	Gold's Gym Carl's Golden Eagle Liquor	1	26,000	15
Montgomery Plaza Palm & Picador	Chief Auto Parts	8	23,500	11

Table IV-2
(Continued)

Name/Location	Anchors	Age	Estimated Square Feet	Vacancy
Palm Ridge Shopping Center Palm & I-805	McDonald's	8	35,000	10%
Country Club Square Hilltop & Naples	7-11 Square Bottle Liquor	15	14,000	11
Imperial Shopping Center 9th and Palm	Big Bear Imperial Beach Pharmacy J.J. Newberry	40	61,000	2
Palm Plaza Palm Avenue & Beyer Way	Otay Farms Market Bank of America	21	50,000	0
Southland Plaza Shopping Center I-5 and Palm Avenue	Carrow's Mervyn's Miller's Outpost Sav-on Drug Von's Home Depot	10	300,000	6
No Name Coronado & 19th	Alpha Beta Thrifty	15	76,000	1
Coronado Village Coronado & 30th	Victory Foods TG&Y	17	26,900	0
Silver Strand Plaza Palm & Rainbow	Sea Coast Market	1.5	43,000	50
Miracle Shopping Center Palm & 9th	Rexall Drugs 10,000 Auto Parts	40	25,000	4
Bay City Plaza Palm & 16th	Blockbuster Video Rent-A-Center Trak Auto	2	40,000	0

Source: *Shopping Center Directory* and respective brokers, January and March 1991.

Chula Vista Center -- Located on the southeast corner of Broadway and "H" Street, this regional shopping center is anchored by three large, chain department stores. First built in 1960, and rehabilitated in 1988, this center is well known and patronized by the shoppers residing in the community around it. Due to its proximity to the U.S./Mexico border, the center attracts foreign shoppers too.

Terra Nova Plaza -- Located to the east of Interstate 805 from the "H" Street off-ramp, this rather large community shopping center is anchored by an off-price chain store, a grocery store, a drug store, a sporting goods store, and a home improvement products store. The center's close proximity to the freeway enables it to attract shoppers from a wide geographic area, as well as the immediate area.

3.0- to 5.0-Mile Radius Market Area

Only community or regional shopping centers were reviewed within 3.0 to 5.0 miles of the project site, as described below.

Bay Plaza -- Located in the 1400 block of Plaza Boulevard, this 150,000-square-foot community shopping center is anchored by Seafood City, Pic 'N' Save, and House of Fabrics. The center's close proximity to another comparable shopping center seems to draw a fair amount of comparison shoppers. Combined, the two centers attract consumers from a regional market area.

Plaza Bonita -- Located on the southeast corner of Sweetwater Road and Plaza Bonita Road, this regional shopping center is anchored by four large, chain department stores. Built in 1981, this center's close proximity to both Interstate 805 and State Route 54 enable it to attract shoppers from a very large geographic area.

San Diego Factory Outlet Center -- Located at 4498 Camino De La Plaza, the last U.S. exit before the border checkpoint, this discount shopping center is anchored by the factory outlets of several different consumer goods manufacturers. These goods include athletic shoes, sportswear, clothing, home tools, toys, cosmetics, lingerie, crystal, cookware, and leather goods. Because of the center's close proximity to the U.S./Mexico border, and its ready access from both I-5 and I-805, the customers come from great distances of either side of the border. There is also a restaurant on the premises.

Sweetwater Town & Country Shopping Center -- Located at 1510 Sweetwater Road, this community shopping center is anchored by drug store, a bowling center, and a fitness center. This center's close proximity to I-805 allow it to attract customers from a wide geographic area like a small regional shopping center.

TOTAL LOCAL RETAIL INVENTORY

ERA reviewed CIC Research's inventory of existing retail space in the neighborhood local Montgomery Specific Plan area (Economic Impact Analysis for Palomar Trolley Center, CIC Research, Inc., January 1990), and revised their inventory account based on a site visit conducted in December 1990. This inventory includes retail outlets found in industrial parks in the market area which serve the local employment base and freestanding retail outlets not found in planned shopping centers.

As adjusted, there is approximately 1,931,000 square feet of space available in the general market area surrounding the project site. This includes all of the Montgomery Specific Plan area. Of this amount, almost 92,000 square feet is office space and almost 99,000 is attributed to employment supported retail space (mostly food outlets and restaurants), for a resident supported retail supply of 1,740,000 square feet. Additionally, there is approximately 60,000 square feet of space being planned or constructed, not including the proposed Palomar Trolley Center.

Table IV-3 presents this adjusted inventory by major retail category. As shown, a large plurality of space is devoted to General Merchandise, followed by Food Stores, and Eating/Drinking Places. Home Furnishings/Appliances, Building Materials, Other Retail Specialty Stores, and All Other Outlets (mostly personal services) were the other major categories.

Table IV-3

PROJECTED MARKET AREA RETAIL SPACE BY MAJOR CATEGORIES
December 1990

Retailer	Market Area (sq.ft.)
Apparel Store	74,055
General Merchandise	407,950
Drug Stores	69,160
Food Stores	216,793
Liquor Stores	11,940
Eating/Drinking Places	213,342
Home Furnishings/Appliances	204,860
Building Materials	163,498
Auto Dealers/Supplies	38,487
Service Stations	14,600
Other Retail Stores	163,189
All Other Outlets	198,936
Vacancies	62,000
Nonretail	91,799
Total	1,930,609

Source: CIC Research and Economics Research Associates.

According to our update of the CIC Research's inventory, vacancies comprised 3.2 percent of total retail space (including community- and regional-supported space); however, most of these vacancies occur in freestanding and smaller retail outlets oriented towards the neighborhood market area. Compared to the supply of existing retail space that is neighborhood supported, (estimated to be over 988,000 square feet as discussed in Section V), we estimate that the current vacancy rate for retail space (including freestanding retail space) that is primarily supported by the neighborhood population is on the order of 6.2 percent. In general, a 5.0 vacancy rate indicates healthy market conditions.

PLANNED AND PROPOSED COMPETITION

At the time of this report's research, with the exception of a few convenience "mini-mall" centers and Genesis Square in Chula Vista, there were no new major planned or proposed shopping centers in the project market area in the near term besides the proposed Trolley Center project, according to the planning departments for Chula Vista, City of San Diego, National City, Imperial Beach, and the County of San Diego.

According to planning department staff interviewed, the following projects are planned and proposed:

Development	General Location	Approximate Size
Hermosa Plaza	Main & Third	6,000 sq.ft.
Genesis Square	Broadway & Palomar	26,700 sq.ft.
Unnamed Center	1053 Broadway	6,000 sq.ft.
Palomar Village	693 Palomar	6,000 sq.ft.
Convenience Centers	Various locations	15,000 sq.ft. (estimate)

These centers, including an estimate for the convenience centers planned, total approximately 60,000 square feet. According to the broker, as of the end of March 1991, Genesis Square is completed and 87 percent preleased.

According to the 1988 Montgomery Specific Plan, there were 187 acres classified as commercial territory, of which 108 acres were in commercial use, 56 acres were in noncommercial use, and 23 acres were vacant. Based on a 25 to 35 percent floor-area ratio, the 23 vacant acres translate into the potential for another 250,000 to 350,000 square feet of retail development. Some of this land may have been developed since the plan was prepared. Reuse of the acreage that is commercially zoned, but is in non-commercial use, would add additional capacity for new commercial development.

SITE COMPETITIVENESS

The proposed Palomar Trolley Center can be competitive. There are several convenience, neighborhood and community shopping centers in various conditions and sizes in the market area. Because some existing shopping centers are getting old and have a narrow market orientation, a well planned and marketed shopping center could fill a consumer void that the other retail centers do not.

The proposed site has a number of factors in its favor. These factors include its size, visibility, access to the freeway, and proximity to a trolley station.

With 198,200 proposed square feet of floor space, the Palomar Trolley Center is relatively large. There is sufficient space available on the 18-acre site to allow for adequate parking.

The location of the site on Palomar Street, east of I-5, between Broadway and Industrial Blvd. makes it fairly visible to vehicular and trolley traffic. Broadway is a heavily travelled north to south primary road that brings consumers into the market area surrounding the project site. From either direction on Broadway, the Palomar Trolley Center would be visible.

Industrial Boulevard is a moderately traveled north to south secondary road that runs parallel to the Palomar Trolley Station and I-5. The project site is clearly visible from either direction on Industrial Boulevard.

Interstate 5 runs north and south for the entire length of the county. Going southbound, the Palomar Trolley Center project site is difficult to see because Palomar Street is an overpass that goes above the surface of the freeway. A thick growth of oleander bushes along the center median impairs the view toward the project site.

Going north on I-5, the project site is fairly visible beyond the trolley station. Depending on the type and height of signage at the completed site, visibility from both directions on the interstate is possible.

Various transportation modes provide access to the Palomar Trolley Center. Personal automobile is the most obvious and popular method for getting to the site. There are surface streets that feed into the project site market area from all four directions. The main ones are Broadway and Palomar Street. These surface streets can be congested, but signal-lighted intersections provide a regulated flow of traffic to and from the market area.

For the shopper who does not wish to navigate through vehicular traffic, there is the Palomar Trolley Station immediately adjacent to the project site that requires a short walk to the mall. There is also the Chula Vista Transit bus service on both Broadway and Palomar Street. Bicycling and walking are the only other methods to get to the Palomar Trolley Center site, but are not consequential.

COMPETITIVE MARKET SUMMARY

The market area is relatively competitive, especially on the neighborhood level. Different stores and types of shopping centers are available to the consumer, all of which have good access and are located on major thoroughfares. Vacancies are low in planned centers, but higher in freestanding buildings oriented towards the neighborhood market. Besides the subject project, a moderate amount of new space (some of which is preleased) is planned and proposed in the near term or under construction, indicating that the market is supporting most of the current space that is available and has capacity to absorb more new space oriented towards certain markets.

However, since the local market population is not growing at a rapid rate, this market support appears to result from shopping centers expanding their market areas rather than support coming from just the local market area.

Section V

ESTIMATED IMPACTS

This section presents the methodology used to estimate impacts, the analysis' findings, and an estimate of the impact the proposed project would have on the existing retail market in the neighborhood market area and the community market area.

NEIGHBORHOOD MARKET AREA IMPACT

The neighborhood market area is defined as 1.5 miles from the project site, and includes the Montgomery Specific Plan Area.

Methodology

Based on 1989 annual taxable sales for San Diego County as reported by the California State Board of Equalization, per capita retail sales in the county were estimated for 1990 by major retail categories. The taxable sales reported for retail categories with a significant portion of nontaxable sales, such as food stores, drug stores, and liquor stores, were adjusted to estimate total retail sales for these categories. The 1989 sales per capita figures were increased by 4 percent to estimate 1990 sales. Finally, the countywide sales per capita estimates were adjusted to reflect the lower income levels in the neighborhood market area.

As shown in Table V-1, the adjusted annual per capita expenditure for each major retail category was applied to the estimated 1992 population in the neighborhood market area to estimate total annual expenditures made by the population living within the neighborhood market area.

Based on CIC Research's retail space inventory, the retail space competing on a neighborhood level was estimated. CIC Research's inventory included all retail space in the neighborhood market area; however, some of this retail space is community or regional serving as well. Neighborhood residents support only a portion of this

Table V-1
1.5-MILE MARKET AREA
1992 SALES CAPTURE
(In 1990 Dollars)

	Per Capita Spending (a)	Amounts
MARKET AREA POPULATION		35,500
TOTAL SPENDING ($1,000)	5.346	$189,783
Comparison Goods	2.471	$87,721
Apparel & Accessory	0.270	$9,585
General Merchandise	0.815	$28,933
Specialty & Misc	0.616	$21,868
Furn & Appliance	0.268	$9,514
Bldg & Hardware	0.502	$17,821
Eating & Drinking	0.657	$23,324
Convenience Goods	1.570	$55,735
Food & Liquor	1.435	$50,943
Drug & Proprietary	0.135	$4,793
Personal & Business Services	0.557	$19,774
Automotive Supplies	0.091	$3,231
ESTIMATED CAPTURE RATE BY EXISTING RETAILERS (b)		Capture Ratio
Comparison Goods		
Apparel & Accessory		1.20
General Merchandise		0.74
Specialty & Misc		1.01
Furn & Appliance		0.78
Bldg & Hardware		0.39
Eating & Drinking		0.19
Convenience Goods		
Food		1.15
Drug & Proprietary		2.56
Personal & Business Services		1.10
Automotive Supplies		1.29
		Square Feet
COMPETITIVE SQ. FT.		988,100
Comparison Goods		458,400
Apparel & Accessory		74,000
General Merchandise		109,000
Specialty & Misc		163,200
Furn & Appliance		47,100
Bldg & Hardware		65,100
Eating & Drinking		33,800
Convenience Goods		261,800
Food		192,600
Drug & Proprietary		69,200
Personal & Business Services		195,600
Automotive Supplies		38,500

(a) based on countywide taxable sales, adjusted for market area incomes.
(b) based on Urban Land Institute' median sales/sq.ft. averages for community centers, adjusted for the Far West

Source: California State Board of Equalization; and Economics Research Associates regional-serving retail space; therefore, only part of this space should count as competitive on the neighborhood level. Since the neighborhood 1.5-mile population comprises 23 percent of the community 3.0-mile population and 14 percent of the 5.0-mile population, a similar proportion of community- and regional-oriented retailers was considered competitive on the neighborhood level. The proportion of community and regional-serving retail outlets that were considered competitive on the neighborhood level was as follows:

General Merchandise:

- 23% of Pic 'N' Save
- 14% of K-Mart
- 14% of Target
- 14% of Price Club

Restaurant:

- 23% of All Restaurants (excluding employment-supported restaurants)

Home Furnishings:

- 23% of All Home Furnishings

Building Materials:

- 14% of Home Club

Also, workers in the market area support approximately 24,200 square feet of food store space, 66,500 square feet of restaurant space, and 3,300 square feet of personal services space according to CIC Research's survey, and should not be considered competitive on the neighborhood level.

As shown in Table V-1 under the caption "Competitive Square Feet," the adjusted competitive retail space on the neighborhood level that is occupied totals 988,000 square feet, of which 458,000 square feet are used to sell comparison goods to neighborhood residents; almost 34,000 square feet are attributed to restaurant space; over 262,000 square feet are used to sell convenience goods; 196,000 square feet are used to offer business and personal services; and almost 39,000 square feet are used to sell automotive supplies. Again, the total amount of space in each category is greater, but these lesser amounts represent the space which neighborhood residents primarily support, as opposed to space that people from outside the neighborhood market area support.

Based on the Urban Land Institute's 1990 annual survey of retail shopping centers in the United States, adjusted for the Far West, we multiplied the median sales-per-square-foot industry standard for major retail categories by the amount of competitive retail space to estimate the potential amount of retail sales that existing neighborhood-serving retail outlets should support.

Finally, we divided this supportable sales figure by the estimated amount the neighborhood population spends each year for retail goods to calculate the percentage of potential neighborhood population expenditures which existing outlets now capture. Estimated existing capture ratios for each major retail category are presented in Table V-1 under the caption "Estimated Capture Rate By Existing Retailers."

Findings

As shown in Table V-1, based on industry median sales standards, the existing supply of neighborhood-serving retail space is adequate to meet almost 120 percent of neighborhood apparel expenditure potential, 74 percent of general merchandise expenditure potential, 101 percent of specialty retail expenditure potential, 78 percent of furniture & appliances expenditure potential, 39 percent of building and hardware expenditure potential, 19 percent of eating and drinking expenditure potential, 115 percent of food expenditure potential, 256 percent of drug store expenditure potential, 110 percent of business and personal services expenditure potential, and 129 percent of automotive expenditure potential.

It appears that the neighborhood market area population is adequately served by existing retail space and that, in general, additional neighborhood serving retail space is not required except for perhaps restaurant space and building and hardware space. Given that Home Depot and Home Club are located in the market area, building and hardware space should include specialty outlets, such as paint, tile, wallpaper, electrical, or nursery outlets.

While estimated expenditures by the neighborhood population for furnishings and appliances and general merchandise could support more retail space in the neighborhood, this additional demand is probably met by regional shopping centers and outlets outside the neighborhood market area.

COMMUNITY MARKET AREA

The community market area is defined as 3.0 miles from the project site.

Methodology

The methodology used was similar to the analysis described for the neighborhood market area, except that here the objective was to estimate the amount of retail space the community 3.0-mile population could support and compare this estimate to the total amount of shopping center space in the community market area to determine if there is sufficient demand to support another center.

Total potential spending by the community-level population was estimated using the same methodology described for the neighborhood level analysis, except that the countywide per capita expenditure estimates were revised to reflect the income level of the community market population.

Unlike the prior analysis, which estimated the current capture rate of existing neighborhood retail outlets, this community level analysis assumed capture rates for the major retail categories. These capture rates vary by type of retail category and are based on ERA's judgment and experience. Not all sales potential is captured on the community level for comparison goods, for example, because people will travel to regional-serving shopping centers for some of these purchases. Almost all food and drug store purchases, however, are made on the community and neighborhood level. While most eating and drinking purchases are made in the community, a proportion of these purchases is made outside the market area. A higher proportion of personal services and automotive supply purchases is assumed to be made within the community.

Applying these capture rates to the estimated total sales potential or buying power of the community market area population results in an estimate of community-supported sales potential.

Using Urban Land Institutes' survey of median sales per square foot for major retail categories, we estimated the amount of community serving retail space which could be supported by the community market population. This analysis is presented in Table V-2.

Findings

We estimate that the community market population of 159,900 people in 1992 could support approximately 4.3 million square feet of retail space in the community, as presented in the shaded portion of Table V-2.

According to the review of shopping centers in the neighborhood and community market areas, there are approximately 3.0 million square feet of retail space in shopping centers in the community market area (which includes the neighborhood market area). Additional retail space in freestanding strip locations or in minor shopping centers not listed in shopping center directories would increase this figure. However, the 3.0 million square feet in planned centers includes a regional shopping center of 823,000 square feet and several large community centers with anchors that have a regional draw, such as Price Club, Home Club, Target, Marshall's, and Home Depot. Therefore, to the extent that this estimate understates total existing retail space in the market area by excluding retail space not found in shopping centers, it overstates the amount of retail space that is community serving since it includes a regional shopping center and regional-serving anchor outlets, only a portion of whose space is supported by the community market population.

Given that the community market area population can support over 4.3 million square feet of community and neighborhood retail space, and an existing supply

Table V-2
3.0-MILE MARKET AREA
1992 SALES POTENTIAL
(In 1990 Dollars)

	Per Capita Spending (a)	Amounts
MARKET AREA POPULATION		159,900
TOTAL SPENDING ($1,000)	6.069	$970,433
Comparison Goods	2.805	$448,520
Apparel & Accessory	0.306	$48,929
General Merchandise	0.926	$148,067
Specialty & Misc	0.699	$111,770
Furn & Appliance	0.304	$48,610
Bldg & Hardware	0.570	$91,143
Eating & Drinking	0.746	$119,285
Convenience Goods	1.782	$284,942
Food & Liquor	1.629	$260,477
Drug & Proprietary	0.153	$24,465
Personal & Business Services	0.633	$101,217
Automotive Supplies	0.103	$16,470
ASSUMED STUDY AREA CAPTURE RATES		
Comparison Goods		
Apparel & Accessory		0.70
General Merchandise		0.70
Specialty & Misc		0.70
Furn & Appliance		0.70
Bldg & Hardware		0.70
Eating & Drinking		0.60
Convenience Goods		
Food		0.90
Drug & Proprietary		0.90
Personal & Business Services		0.70
Automotive Supplies		0.70
SALES POTENTIAL ($1,000)		$724,363
Comparison Goods		$313,964
Apparel & Accessory		$34,251
General Merchandise		$103,647
Specialty & Misc		$78,239
Furn & Appliance		$34,027
Bldg & Hardware		$63,800
Eating & Drinking		$71,571
Convenience Goods		$256,448
Food		$234,429
Drug & Proprietary		$22,018
Personal & Business Services		$70,852
Automotive Supplies		$11,529
SUPPORTABLE SQ. FT. (b)		4,301,782
Comparison Goods		2,127,071
Apparel & Accessory		219,555
General Merchandise		526,128
Specialty & Misc		575,287
Furn & Appliance		215,359
Bldg & Hardware		590,742
Eating & Drinking		534,114
Convenience Goods		895,546
Food		771,149
Drug & Proprietary		124,397
Personal & Business Services		638,304
Automotive Supplies		106,748

(a) based on countywide taxable sales, adjusted for market area incomes.
(b) based on Urban Land Institute' median sales/sq.ft. averages for community centers, adjusted for the Far West.

Source: California State Board of Equalization; and Economics Research Associates of community-serving retail space that is below this amount, it appears that the market could support additional community-serving retail space, especially community-serving space which also reaches a regional population.

ESTIMATED IMPACT

It is our opinion that the portion of the proposed Palomar Trolley Station that will generate high taxable sales and are probably community and regional serving (65 percent of the total retail space proposed) could be supported without adversely affecting the community market area. This is not to say that new community and regional-serving outlets will not compete with other stores in the market area. Competition would be expected; however, we believe there is sufficient market population to support more competitors based on average sales-per-square-foot standards. Some outlets that have higher than average sales standards due to less competition may see their sales decline somewhat as new competitors enter the market, but despite this decline, their sales should still be adequate and meet industry standards if they are well managed. Consumers will benefit from increased shopping alternatives.

However, the portion of the proposed project that need not generate high taxable sales (35 percent of the total retail space) and the proportion of the regional-serving uses that are supported by the neighborhood market population (estimated to be 14 percent of the 65 percent of the total retail space proposed), we believe could be redundant in the neighborhood market area and could have a negative impact that might result in an increase in the neighborhood market area vacancy rate or a reduction in supportable rents. The extent of this negative impact depends on the amount and types of neighborhood-serving space introduced. The potential total amount of neighborhood-supported retail space in this project is over 87,400 square feet, based on 35 percent of 198,200 total space in the shopping center (which equals 69,400 square feet) plus 14 percent of the 65 percent of total space devoted to regional-serving anchors (which equals 18,000 square feet).

Introducing 87,400 square feet of new neighborhood-supported space into a market area that already has 1,050,000 square feet of neighborhood-supported space, of which 62,000 square feet, or 5.9 percent, is vacant, could potentially increase the current neighborhood-serving vacancy rate to almost 13.1 percent or higher depending on how much planned and proposed space is preleased. Most of this vacancy would be expected to occur in the older retail centers and freestanding retail space rather than in the newer retail centers, which have experienced low vacancy rates. A likely alternative impact, instead of greater vacancies, is lower supportable rents at some outlets and centers.

If some or all of the lower taxable sales space (the 35 percent share) is devoted either to outlets which serve a community or regional population (either directly or indirectly by capturing customers visiting the regional-draw anchors), the impact on the neighborhood market area would be less. Also, if some of this lower taxable sales space is leased to restaurants and specialty building material outlets, the impact would be less in our opinion.

In summation, it is our opinion that the proposed Palomar Trolley Center project can be supported on the community and regional level without adversely affecting the total community retail market, although certain retailers may see their current market share fall somewhat as new competition is introduced. The proposed project, however, could have a negative impact on the neighborhood-serving market by introducing additional neighborhood-serving retail space in a stable neighborhood market that is not growing. Certain mitigation measures, stipulated in the future Disposition and Development Agreement (DDA), can be taken to reduce this potential impact.

Possible Mitigation Measures

The existing Semi-Exclusive Negotiating Agreement with Pacific Scene, Inc., for Commercial Shopping Center at South Side of Palomar Between Industrial and Broadway, Section V., A., 7., stipulates that the "Disposition and Development Agreement" (DDA), include a clause that restricts the developer from leasing or selling to tenants or purchases greater than 15,000 square feet of net usable floor area until the Executive Director of the Redevelopment Agency of the City of Chula Vista has approved the tenant. Approval can be withheld if the Agency finds and reasonably determines, at a public meeting and after notice is provided to the developer, "that the proposed tenant or purchaser is incompatible with the commercial mixture of tenants present in the market area of the Project." This provision in the future DDA, if applied effectively by the Agency to protect over-building of neighborhood-oriented uses in the neighborhood market area, can mitigate the project's potential negative impact.

This mitigation measure could reduce the potential negative impact upon the neighborhood market area. Still, as new centers are developed over time, the older obsolete centers will have difficulty competing even if the market is not overbuilt. Older centers might upgrade to stay competitive, but only if they are able to sustain sufficient rents and occupancies to amortize the improvement costs.

Finally, this proposed project concept, with significant portions devoted to regional and community-serving outlets, would have less impact than a similar size concept which is only neighborhood serving. Despite its potential impact on some existing neighborhood-serving retailers, the proposed project concept should generate a net fiscal surplus to the City since its anchors will draw customers and taxable sales from outside Chula Vista.

KLEINFELDER

January 15, 1991
Project No. 53-1248-00-100

Mr. John Bridges
Cotton/Beland/Associates, Inc.
619 South Vulcan Avenue, Suite 205
Encinitas, CA 92024

PREACQUISITION SITE ASSESSMENT
Palomar Trolley Center
Chula Vista, California

Dear Mr. Bridges:

Kleinfelder is pleased to submit this report of our Preacquisition (Phase I) Site Assessment for the property located at the southwest intersection of Broadway and Palomar Street in Chula Vista, California (refer to Plate 1 - Site Location Map).

BACKGROUND

During December 1990, Kleinfelder completed a Phase I Preacquisition Site Assessment for Cotton/Beland/Associates. This assessment was based on the scope of work presented in Kleinfelder's Proposal No. 53-YP0-076 dated September 12, 1990 and the Amendment letter dated November 8, 1990.

At the time of our site reconnaissance, the subject property for this study (Assessor's Parcel Nos. 622-04-17, -20, -21, -22, -23 and 623-03-25, -23, -22, -15, -11, -10, -9) included a 7-11 with gasoline pumps, a laundromat, Zoralia's Restaurant, Sam's Trailer/RV storage and rental, single and multi- family homes, and a church (see Plate 2 - Site Plan).

We understand that Cotton/Beland/Associates in conjunction with the developer, Pacific Scene, and the City of Chula Vista, are interested in re-developing these parcels and approximately 12 acres of surrounding land as the Palomar Trolley Center. This proposed project would include retail business, two fast-food drive through restaurants, and a possible bowling alley. Possible amenities include a linear park and bicycle park in the San Diego Gas and Electric (SDG&E) easement to the south, pedestrian linkage to the trolley station, traffic circulation link and loop, and an onsite or offsite daycare center.

The limitations of this study are discussed at the end of this report.

ASSESSMENT ACTIVITIES

The Phase I Preacquisition Site Assessment included the following tasks:

- A review of historical aerial photographs, available title documents, and reports to evaluate land use history.
- A review of geologic and hydrogeologic literature to assess what factors may threaten the site if nearby properties are found to be contaminated.
- Review of federal, state, and local regulatory lists of hazardous materials generators, landfills, military reservations, contaminated surface water, leaking underground storage tanks, and EPA Superfund sites located within one mile radius of the subject site.
- Reconnaissance of the property and buildings on the site and adjacent properties to evaluate their current land use and look for evidence or potential sources of contamination and the presence of hazardous substances.
- Preparation of this report of findings.

HISTORICAL AERIAL PHOTOGRAPH REVIEW

Historical aerial photographs were reviewed at the San Diego County Public Works Department. During the review, Kleinfelder looked for evidence of hazardous materials and onsite and offsite features which might affect the environmental quality of the property. These features included, but were not limited to, sumps, pits, ponds, lagoons, aboveground tanks, landfills, outside storage of hazardous materials and general land use.

<u>March 31, 1953 Photograph AXN-3M-79, Scale 1' = 1666', Black and White (stereo pair unavailable)</u>
In the 1953 photograph, a dirt road extends from Broadway, at the northeast corner of the property, diagonally across the property to the southwest corner. There are six buildings on either side of this road. The buildings appear to be residential but these features can not be confidently identified at this scale. A vertical shadow indicates the presence of a water tank adjacent to the road near the center of the property. The site is surrounded by agricultural property. Palomar Street does not extend west of Broadway in 1953 and the 5 Freeway has not yet been constructed.

October 26, 1966 Photographs GS-VB01 7,8, Scale 1" = 2000', Black and White
At the northeast corner of the property is a building with approximately a dozen vehicles parked around it. There is little significant change observed with regard to the other buildings on the property. The property adjacent to the north and west of the subject site is used for agriculture. The adjacent property to the south appears to be a vacant dirt lot where it boarders the eastern part of the subject site (parcels 622-04-23 and -22) and agricultural where it borders the western half of the property.

June 14, 1972 Photographs SDC T12 37-2,-3, Scale 1" = 1000', Color
Three reddish roofs, in a typical service station configuration, have replaced the building on the northeast corner of the property (parcel 622-04-21) seen in the 1966 image. It appears that these may represent two pump awnings and the service center or garage. On the southeastern portion of the property, where there used to be a dirt lot in the 1966 photographs, (parcels 622-04-22, -23), there appear to be two large buildings with several vehicles parked in front and in back of them. A long paved road leads to the parcel 622-03-25 which supports a square building with an empty parking lot (the location of the present church). The eastern parcels remain residential in appearance. The present day Zoralia's restaurant (on parcel 622-04-20) appears as a square building with cars parked immediately to the front and back of it.

Rooftops in the configuration of a gas station are present to the north of subject property, on the northwest corner of Broadway and Palomar. There appears to be small commercial/retail centers on the northeast and southeast corners of Broadway and Palomar. The 5 Freeway is visible approximately one mile to the west.

December 5, 1973 Photographs, SDPD 23-7,-8, 1' = 1000', Color
The subject site appears unchanged since the 1972 depiction with the exception of a power line which crosses the southern part of the property.

February 17, 1979 Photographs, SDCO C-21,22, 1" = 1000', Color
The northeast corner of the property is vacant, the three roof tops in the 1972 aerial photograph are no longer present.

November 26, 1983 Photographs, CAS 567, 568, 1" = 1000', Black and White
A new building is present in the northeast corner. The remainder of the subject property appears relatively unchanged.

REVIEW OF PRELIMINARY TITLE REPORT

Cotton/Beland/Associates provided Kleinfelder with a Preliminary Title Report prepared by First American Title Insurance Company dated September 26, 1990. The majority of the parcels are owned primarily by individuals or by non-profit organizations which did not seem to be cause for environmental concern. There is a SDG&E easement along the southern part of the property. Site reconnaissance indicated the presence of overhead power lines in that area.

PUBLIC RECORDS REVIEW

Regulatory Agency File Review

Kleinfelder reviewed the following public records for past and current status with respect to permitting and violations of the subject property and surrounding area (hazardous materials sites are plotted on Plate 3):

> United States Environmental Protection Agency (EPA) Superfund Program, Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) list (dated 4-25-90).
>
> United States Environmental Protection Agency (EPA), Office of Emergency & Remedial Response, National Priorities List (NPL). Supplementary Lists and Supporting Materials, (dated 2-90).
>
> State of California Governor's Office of Planning and Research, Hazardous Waste and Substances Sites List (Cortese) (dated 3-90).
>
> State of California, Health and Welfare Agency, Department of Health Services (DHS), Toxic Substances Control Division, Expenditure Plan for the Hazardous Cleanup Bond Act (BEP) of 1984, Revision No. 3 (dated 1-88).
>
> State of California, Department of Health Services, Abandoned Site Program Information System (ASPIS) Facility Profile Report (dated 8-6-87).
>
> State of California, Regional Water Quality Control Board (RWQCB) San Diego Region Underground Tank List (dated 5-29-90) and (2) Solid Waste Disposal Sites - San Diego County Solid Waste Assessment Program (SWAT) list (dated 7-13-89).
>
> County of San Diego, Department of Health Services, Division of Environmental Health, Hazardous Materials Management Division (HMMD) (1) Unauthorized Release list (dated 7-13-89) and (2) Tank Permits Information (dated 9-30-90).

Assembly Bill 1803 - Contaminated wells (personal communication with John Anderson, Geologist, San Diego RWQCB, (8-28-89).

Munger Map Book (data on wells from State of California , Department of Natural Resources - Division of Oil and Gas, Oil Operators, Munger Oilogram, and other journals) 33rd Edition, (5-89).

Review of the CERCLIS and the NPL lists did not indicate the presence of potential superfund sites or existing superfund sites within a one half mile radius. However, within a one mile radius there was one site on the CERCLIS list.

1. Nelson and Sloan - 7th Street and Main Street, approximately three-quarters of a mile southeast of the subject property.

Nelson and Sloan is a cement batch facility. The site is also listed on the Cortese list as the site of a tank leak. County data bases, RWQCB Leaking Underground Tank List and HMMD Unauthorized Release Listing, indicate that an underground storage tank failed a precision test on 10/27/86. The case is listed as closed as of 12/04/86 by the HMMD.

Three other sites are listed by the Cortese list within one mile of the subject property.

2. Thrifty Service Station #414 (also listed as AM/PM #5128) - 1725 Broadway, approximately one-half mile southeast of the subject property.

The Thrifty Service station is listed by the Cortese list as the site of a tank leak. According to the HMMD Unauthorized Release list, the release involving soil contamination occurred on 10/30/86. The case was closed by the HMMD on 3/31/87.

3. The Transportation Department (also listed as Sweetwater Union High School District) - 1130 5th Avenue, approximately one half mile north of the subject property.

The Transportation Department is listed by the Cortese list as the site of a tank leak. The Unauthorized Release list indicates that a leak involving the contamination of soil occurred on 10/06/86. This case is listed as being under preliminary site assessment by the HMMD.

4. Savage, Steve (also listed as Apollo Gas) - 1264 3rd Avenue, approximately three-quarters of a mile northeast of the subject property.

This site is listed by the Cortese list as the site of a tank leak. The HMMD Unauthorized Release list, indicates that a leak involving the contamination of soil occurred on 1/30/89. This case is listed as being under preliminary site assessment by the HMMD.

Review of the BEP and ASPIS lists did not indicate sites within one mile of the subject property. The SWAT list did not indicate landfills within one mile radius. Information from the RWQCB and the Munger Map Book did not indicate contaminated wells as per AB1803 or oil wells within a one mile radius.

The RWQCB Leaking Underground Tank List and the HMMD Unauthorized Release List indicate twelve underground tank leak sites within a one mile radius of the subject property. All of which have been remediated and closed by the appropriate agency.

It is not likely that the site will fall under the provisions of Section 25221 of the Health and Safety Code since regulatory review did not locate hazardous materials violations within a 2000 foot radius.

The three underground storage tanks at the 7-11 store did not appear on the state or local leaking underground tanks lists which were reviewed. The HMMD Tank Permits Information data base indicates that there are three underground fuel tanks on the property. Each tank contains 9816 gallons of unleaded, regular leaded, or premium leaded fuel. The tanks are single-walled tanks without secondary containment and operate under an interim permit. The tanks are monitored using daily inventory reconciliation. The HMMD data base indicates that the tanks were inspected on 04/03/90. The tank system was tight and passed inspection. Regulatory review did not indicate violations for this site.

Regulatory Agency Contacts

Chula Vista Fire Prevention was contacted regarding any "hazardous material emergency responses" for the permitted underground fuel storage tanks at 603 Palomar Street (7-11 store). They had "no record of any problem at this time."

Several agencies were contacted regarding the dumping station noted at Sam's Trailer Service. According to HMMD, recreational vehicle holding tank effluence is not considered to be industrial waste (defined as "manufacturing or processing in origin with potential contaminants or toxics"). It is considered to be domestic in nature and is handled accordingly regardless of volume of operation.

East County Environmental Health Services, Land Use Division (which handles wells and septic tanks in the Chula Vista region) was contacted regarding the possible presence of a holding tank at the dumping station. Their records, which have been kept for ten years, did not indicate any such septic facility at 1330 Broadway. City of Chula Engineering verified that there is a sewer lateral at 1330 Broadway but was unable to verify the main's capacity.

GEOLOGY AND HYDROGEOLOGY

The subject property is located in Section 15, Township 18 south, Range 2 west, San Bernardino baseline and principal meridian. The approximate elevation of the site is 60 feet above mean sea level (USGS 7.5 Minute Topographic Series, Imperial Beach Quadrangle).

The site is located within the western portion Peninsular Ranges geomorphic province of California. This province is characterized by a series of northwest-trending ridges and valleys underlain by structural blocks separated by major strike-slip fault systems. Locally, the site is located on a thick sequence of coastal marine and nonmarine sedimentary rocks of the San Diego Embayment. According to published geologic maps, (Geology of National City, Imperial Beach and Otay Mesa quadrangles, California, Map Sheet 29, California Division of Mines and Geology.), the site is underlain by the Pleistocene (11,000 to 2,000,000 years before the present) Bay Point Formation, consisting locally of fine to medium grained silty sandstones and sandy siltstones. The Bay Point Formation is underlain by the San Diego Formation.

According to the "Comprehensive Water Quality Control Plan for the San Diego Basin," prepared by the Regional Water Quality Control Board, San Diego Region (1975), the subject property lies within the Otay Hydrographic subunit of the Otay Hydrographic Unit. There is a limited amount of available data concerning the depth to groundwater direction of groundwater gradient, and groundwater quality in the site area. Kleinfelder has not conducted any subsurface exploration at the site. Our comments concerning groundwater depth, gradient direction, and water quality are estimated based on our review of the available data and of conditions in the general area.

The Department of Water Resources Bulletin 106-2 indicates that the depth to groundwater in the wells in the area is generally greater than 100 feet. There may be perched water conditions above the true groundwater table. The groundwater is within the San Diego Formation. The San Diego Formation is more than 1000 feet thick and most wells in the formation are 300 to 800 feet deep. Based on the topography of the site and surrounding area, we estimate that groundwater gradient toward San Diego Bay.

Groundwater in the Otay Hydrographic Unit is designated as having existing beneficial uses for industrial applications. Water from wells in the area is high in total dissolved solids (500-2000 ppm) because of connate water in the San Diego Formation.

SITE RECONNAISSANCE

The site visit was conducted on December 18, 1990 by Ms. Theresa Congdon, Staff Environmental Specialist and Mr. Tony Sawyer, Senior Hydrogeologist of Kleinfelder. Kleinfelder looked for evidence of aboveground or underground storage tanks, discharges, discolored soils, odors, wells, and other indications of potential environmental concern.

It is our understanding from Cotton/Beland/Associates that this project is in its initial stages. A more in-depth review of daily onsite activities is anticipated as part of an additional work package at a time when the client is able to provide and authorize admittance to all buildings and private residences. Based on this understanding with Cotton/Beland/Associates and for the sake of confidentiality at this stage of the project, Kleinfelder did not interview onsite tenants. The following observations are based on reconnaissance of areas available to the general public. The site walk was conducted in a clockwise manner beginning with Parcel No. 622-04-21, the laundromat and 7-11 store with gasoline station.

Evidence was not observed of unusual chemical storage or handling in the accessible areas of the 7-11 store and the coin laundry. Visual assessment of the building materials (wall, ceiling tile, floor tile) did not indicate the use of products typically containing asbestos (i.e., 9 by 9 vinyl floor tile, sprayed-on surfacing, apparent insulated surfaces). However, our walk-through did not include assessment of possible false ceilings, thermal system insulation, or roofing. Building plans were not provided for review by Kleinfelder of possible asbestos containing building materials. For any buildings scheduled for demolition, suspected asbestos containing material must be sampled and removed (if more than 160 square feet and 260 linear feet) prior to demolition (National Emission Standards for Hazardous Air Pollutants 40 CFR 61 Part M). Some scattered paper litter around the dumpsters was observed in the alley behind the 7-11 store and coin laundry building.

The gasoline station associated with the 7-11 store consists of one pump island. Regulatory review did not indicate violations for this site. Kleinfelder recommends that prior to the construction of the proposed development, these tanks be removed and that the required soil sampling be conducted to assess whether or not contamination from the underground fuel tanks has occurred.

Sam's Trailer Service occupies parcel nos. 622-04-22 and -23. It appears to be a trailer/recreational vehicle supply, sale, and service center. An approximately 8 foot long aboveground propane storage tank was observed on the northeast corner of the parcel. On the southeast corner of the parcel, there is an RV dumping station for sewage. The asphalt concrete over the below ground sewage tank does not appear intact. The retail building faces Broadway and there appears to be a private residence in back. The service area is in an enclosed dirt lot behind the retail building.

A narrow paved road parallel to and just south of the property boundary runs from Broadway to the Jehovah's Witness church and parking lot (parcel 622-03-25). Another propane tank appeared to be located on this property; however, this was not confirmed. There is a duplex and two single family residences located on the remaining parcels on the western part of the property. There appear to be enclosed storage areas around these residences, a few pickup trucks, storage units, cement mixers, maintenance equipment, and concrete debris.

Zoralia Restaurant occupies parcel 622-04-20. There are parking spaces in front of and behind the building.

A corrugated steel drainage pipe, which ran beneath the 7-11 store alley, surfaced behind Zoralia's. The runoff continued in a drainage ditch which re-enters the study area near the residential units.

One ground mounted transformer was observed in the alley behind the 7-11 store. Other pole mounted transformers were observed on the overhead power line poles that run along the southern boundaries of the property. Previous correspondence with SDG&E (see Appendix B), indicates that SDG&E believes it is unlikely that their transformers contain PCBs. SDG&E will test transformers upon request. If PCBs are found there will be no charge for analytical testing to the interested party.

Visual indication or evidence that fill was brought onto the site was not observed.

OFFSITE RECONNAISSANCE

Evidence of previous groundwater monitoring activity was observed approximately 100' northwest of parcel 622-03-10. A wellhead, a 55 gallon drum labeled as soil, and an electrical power line presumably for the operation of monitoring well equipment were observed.

The storage shed on the adjacent property, which was investigated by Woodward-Clyde Consultants, is located half way between the subject property and Palomar Street. The shed, made of corrugated metal, was boarded shut and surrounded by a dozen to two dozen 55 gallon drums.

Cotton/Beland/Associates provided Kleinfelder with Woodward-Clyde Consultants "Environmental Site Assessment Palomar Street and Broadway, Chula Vista, California, dated February 22, 1990." According to this report, the shed was used to store pesticides and agricultural vehicles were parked around it. In addition, one aboveground tank of approximately 500-gallon capacity used for diesel fuel and one underground storage tank of 280-gallon capacity used for regular gasoline are located near the north end of the shed.

(The aboveground storage tank was no longer present at the time of the site reconnaissance.) It is likely that the 55 gallon drums around the site were generated during soil sampling investigations for this site.

According to their report, Woodward-Clyde Consultants sampled soil and found Toxaphene (an organochlorine pesticide) and DDT at concentrations above the Total Threshold Limit Concentration (TTLC) levels. Further sampling and completion of Health Risk Assessment is recommended if that portion of property is included with the subject property.

The adjacent property to the south is vacant and covered by tumbleweed and grass; it is part of the SDG&E overhead power line easement. The adjacent property to the west is vacant and tilled with evidence of sampling activities observed near the storage shed and near the northeast corner of the subject property. The property is bordered by Palomar Street to the north and across the street, Ralph's Grocery Store. A service station is located on the northwest corner of Palomar Street and Broadway. Retail construction is occurring on the northeast corner of Palomar Street and Broadway and an existing retail center is present on the southeast corner. The existing Palomar Trolley line is located one quarter mile east of the subject property.

Hazardous materials generators within one mile of the subject property were discussed in the Public Records Review Section.

FINDINGS AND RECOMMENDATIONS

Historical aerial photograph review indicates that the property has been partially developed since at least 1953. The western half of the property appears to have supported private residences while retail buildings have occupied the eastern half. The 1972 photograph indicates the presence of a gas station on the northeast corner of the property.

Review of the Preliminary Title Report did not show activities or ownership that indicate cause for environmental concern.

Review of public records indicated fifteen hazardous materials generator sites within a one mile radius of the site. The majority of these have been investigated and closed by the appropriate agencies with the exception of the Transportation Department at 1140 5th Avenue and Apollo Gas at 1264 3rd Avenue. These two sites are under preliminary site assessment for an unauthorized release. Neither of these sites is within a quarter mile of the subject site. Due to the distance from the subject property, it is unlikely that these sites would pose a significant environmental concern to the subject site.

Regulatory review of the HMMD's Tank Permits Information data base did not indicate violation for the three underground fuel storage tanks associated with the 7-11 store.

Kleinfelder recommends that prior to purchase of the property, soil sampling be conducted to assess whether or not contamination from the underground fuel tanks has occurred.

A propane tank was observed at the northeast corner of Sam's Trailer Service. There also appeared to be another tank within the fenced area near the northeast corner of the church; however, this was not confirmed. Kleinfelder recommends that prior to the construction of the proposed development any aboveground tanks be removed. If there is any indication of discolored soils or unusual odors under or around the tank, Kleinfelder recommends soil samples be obtained and analyzed for possible hydrocarbon contamination. The client may wish to obtain verification samples even if there is no apparent evidence of contamination.

An RV dumping station for sewage was observed on the southeast corner of Sam's Trailer Service. Kleinfelder recommends that prior purchase of the property, soil sampling be conducted to assess whether sewage or other substances have leaked or been spilled in the area of the tank.

Evidence was not observed of unusual chemical storage or handling in the areas accessible to Kleinfelder. A more in-depth assessment of daily onsite activities and observation of enclosed and restricted areas is recommended. In particular, the repair and service area associated with Sam's Trailer Service and the enclosures surrounding the private residences should be observed for use or storage of petrochemicals or other hazardous materials.

Prior to the renovation or demolition or existing buildings on site, Kleinfelder recommends that the structures be sampled for asbestos containing building materials (ACBM's).

Based on previous correspondence from SDG&E, it is unlikely that the ground mounted transformer onsite and the pole mounted transformers contain PCBs. However, SDG&E will test transformer for PCBs upon request for a fee.

The adjacent property to the northwest shows indications of two areas where monitoring wells have been installed. Cotton/Beland/Associates provided Kleinfelder with a report prepared by Woodward-Clyde Consultants which indicates that one 500 gallon aboveground fuel tank and one 280 gallon underground fuel tank were located near a pesticide storage shed. At the time of our site walk, the aboveground tank was no longer present. Kleinfelder recommends that the underground tank be removed, if it has not already been removed. Further sampling and completion of a Health Risk Assessment is recommended if this property is to be included in the project.

Offsite reconnaissance indicates that the site is surrounded primarily by commercial structures and small businesses. There is a service station adjacent to the site across Palomar Street. However, violations for this site were not indicated in the regulatory review.

It is Kleinfelder's opinion, based on the distance of the identified hazardous materials sites, that the likelihood of chemical contamination to the soil and groundwater at the subject site from offsite sources is low. Without access to all areas and activities on the subject property, Kleinfelder is not able to assess the impact from onsite activities to the site. The findings and recommendations previously discussed are based on observed activities and conditions.

Kleinfelder recommends that when access to all areas is available an in-depth assessment be conducted. This would include interviews with each tenant, reconnaissance of all areas of the buildings including service areas and chemical storage areas, private residences, and enclosures. Assuming all tenants and/or owners were available for interviews and all buildings were accessible during a two day period, it is estimated that field activities could be completed within 8 to 12 hours dependent on the availability and cooperation of tenants and owners. An amendment to this report could be available a week after the field work is complete. The estimated cost for this work would be between $1,800 to $2,000 excluding costs of ACBM sampling and analysis.

LIMITATIONS

This report is prepared for the sole use and benefit of Cotton/Beland/Associates and based in part upon documents, writings, and information owned and possessed by Cotton/Beland/Associates. Neither this report, nor any information contained herein, shall be used of relied upon by any person or entity other than Cotton/Beland/Associates.

The conclusions in this report are based on the following:
1. The observations of our personnel
2. Information supplied by Cotton/Beland/Associates
3. Information obtained by review of regulatory records

Kleinfelder performed this assessment in accordance with our Proposal and Contract No. 53-YP0-076 and amendment letter dated November 8, 1990 and the conditions and limitations stated therein. The services performed by Kleinfelder have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession practicing under similar conditions in Southern California. No warranty, express or implied, is made.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both onsite and offsite) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use by executing the "Application for Authorization to Use" which follows this document as an Appendix. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

We appreciate the opportunity of providing our services to you on this project, and trust that this report meets your needs at this time. If you have any questions or would like us to prepare a proposal for supplemental investigations, please do not hesitate to contact us.

Sincerely,

KLEINFELDER, INC.

Prepared by:

Theresa H. Congdon

Theresa H. Congdon
Staff Environmental Specialist

Randolph C. Harris

Reviewed by:

Randy C. Harris
Senior Environmental Consultant

THC/RCH:sf

Enclosures:

Plates

Plate 1 - Site Location Map
Plate 2 - Site Plan
Plate 3 - Hazardous Materials Map

Appendix A - Site Photographs
Appendix B - Correspondence

APPLICATION FOR AUTHORIZATION TO USE

PREACQUISITION SITE ASSESSMENT
PALOMAR TROLLEY CENTER
PROJECT NO. 53 1248-00-100

TO: Kleinfelder, Inc.
9555 Chesapeake Drive, Suite 101
San Diego, California 92020

FROM: ______________________________

____

____

____

[Please clearly identify name and address of person/entity applying for permission to use or copy this document]

Gentlemen:

Applicant ______________________ hereby applies for permission to:
[State here the use(s) contemplated]

for the purpose(s) of:
[State here why you wish to do what is contemplated as set forth above]

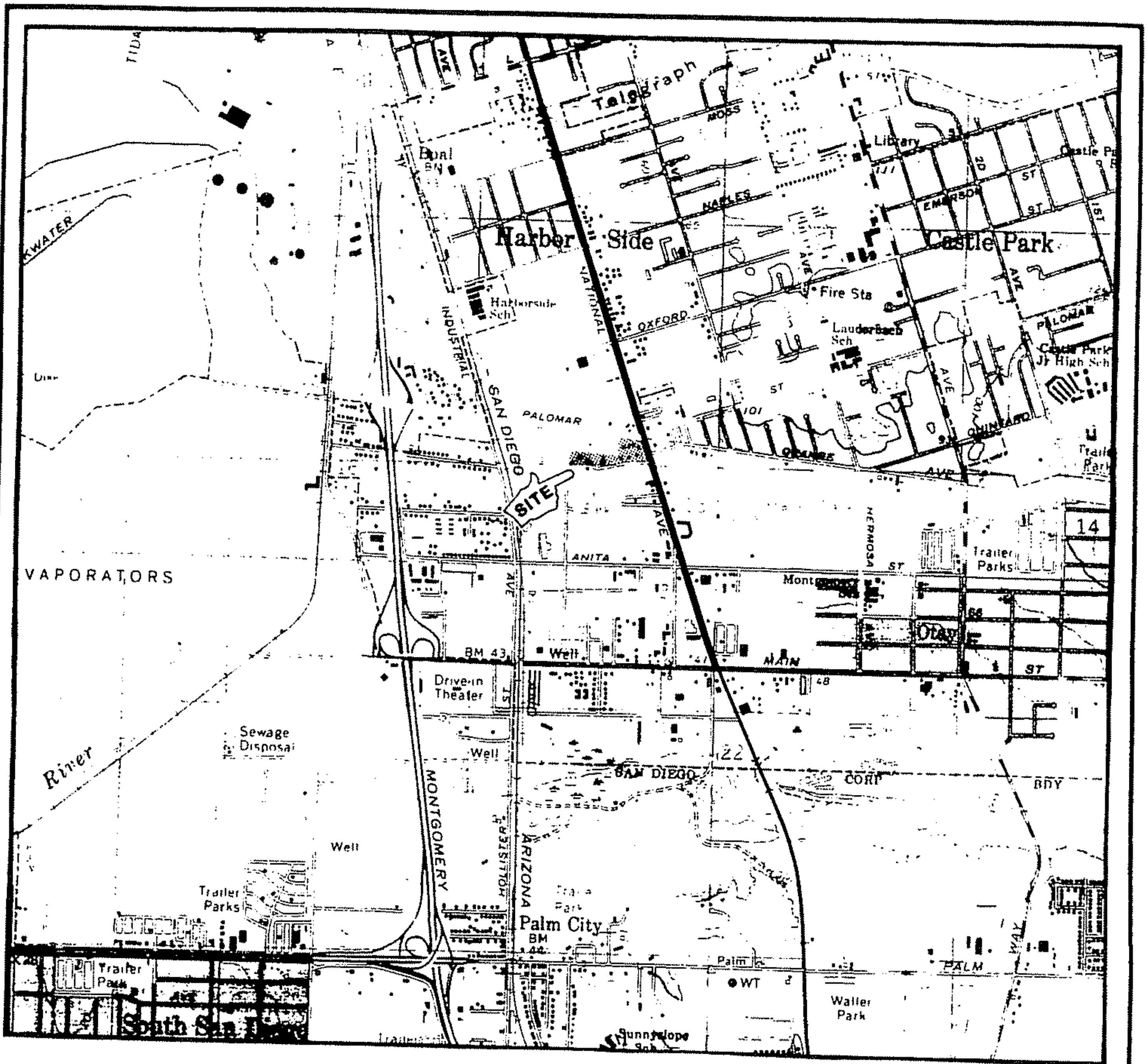
Applicant understands and agrees that ________________________ is a copyrighted document, that Kleinfelder, Inc. is the copyright owner and that unauthorized use of copying of ____________________ is strictly prohibited without the express written permission of Kleinfelder, Inc. Applicant understands that Kleinfelder, Inc. may withhold such permission at its sole discretion, or grant such permission upon such terms and conditions as it deems acceptable, such as the payment of a re-use fee.

Dated:_______________

____
Applicant

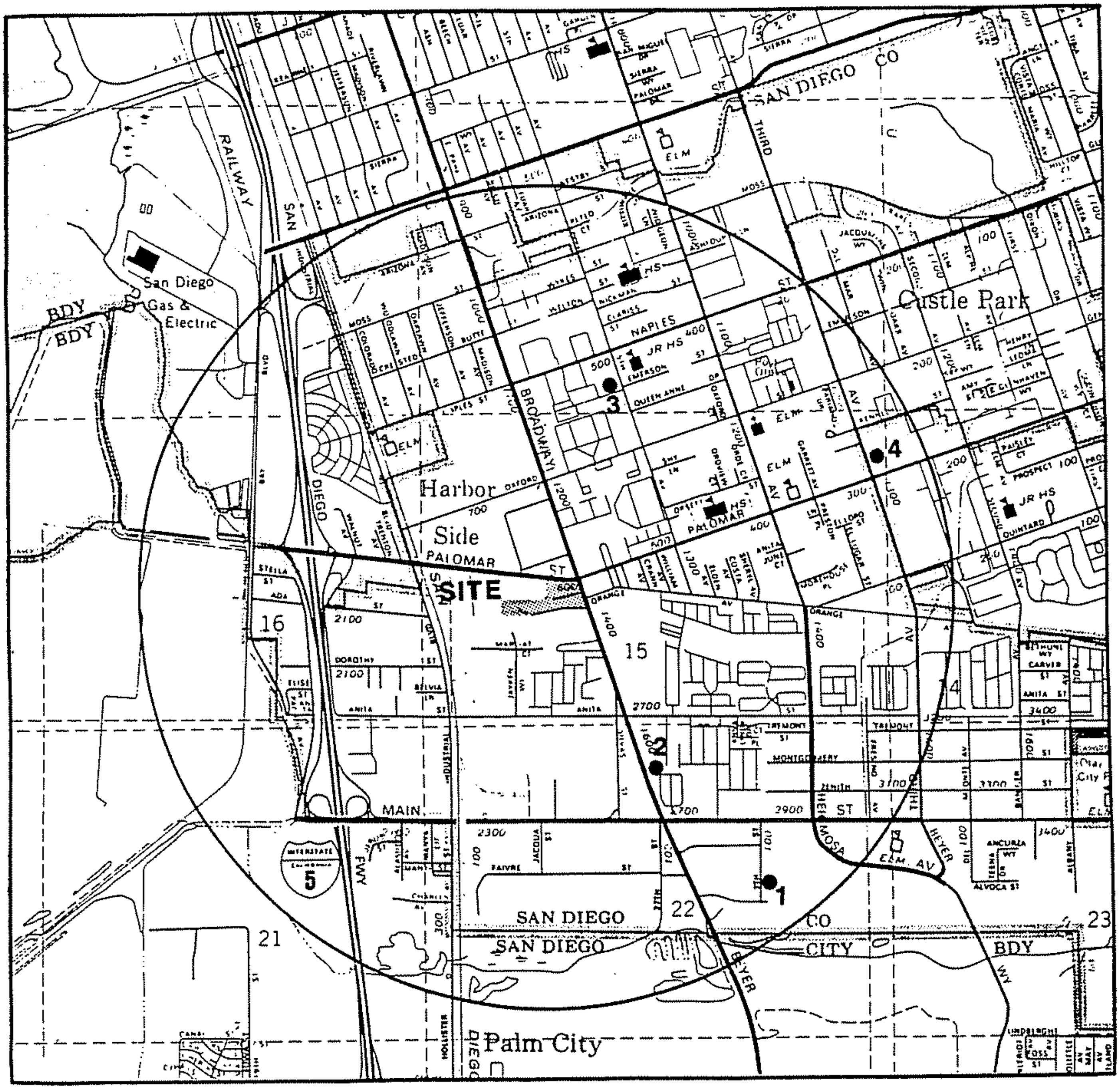
by____________________________
Name

its____________________________
Title



Basemap USGS 7.5 Minute Series Topographic Map
Imperial Beach Quadrangle, Photorevised 1975

KLEINFELDER	**SITE LOCATION MAP** **Palomar Trolley Center** **Chula Vista, California**	PLATE 1
PROJECT NO. **53-1248-00-100**		



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Key

● # Indicates approximate HMS location

ONE MILE RADIUS INDICATED

The Base Map is from Aerial Photo Map Book, 1986-1987, Page 18G, San Diego County, California.

KLEINFELDER

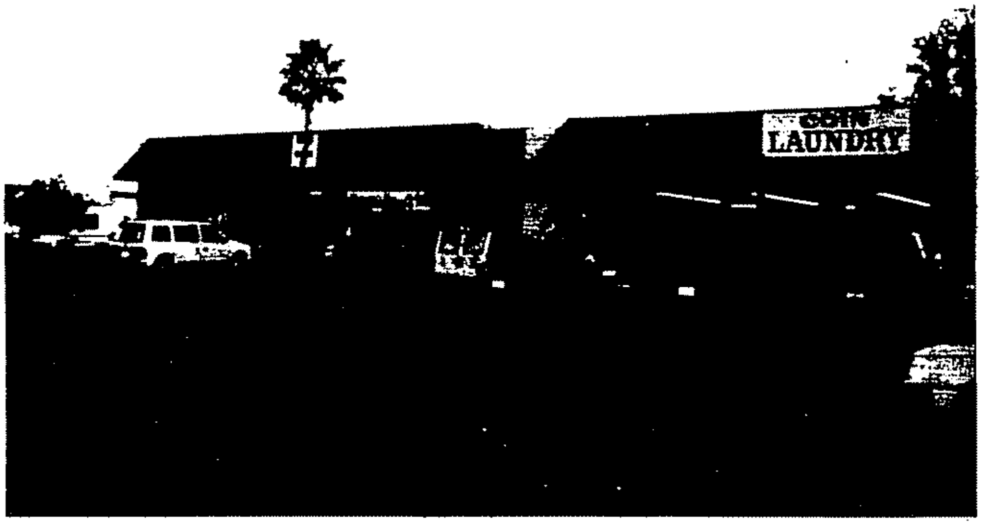
HAZARDOUS MATERIALS SITES

Palomar Trolley Center
Chula Vista, California

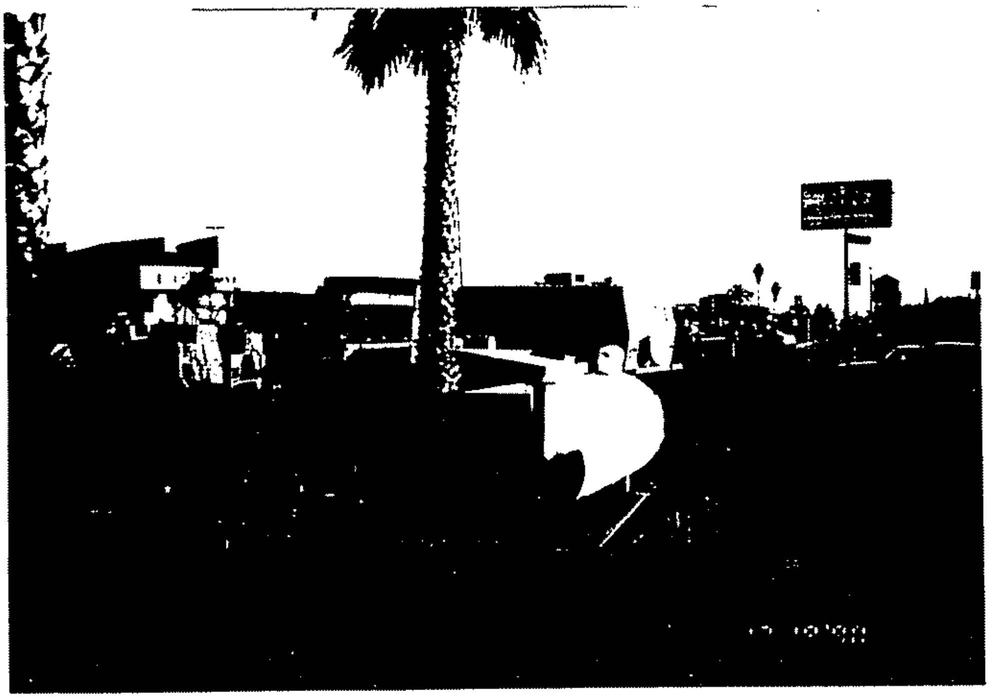
PLATE

3

PROJECT NO. 53-1248-00-100

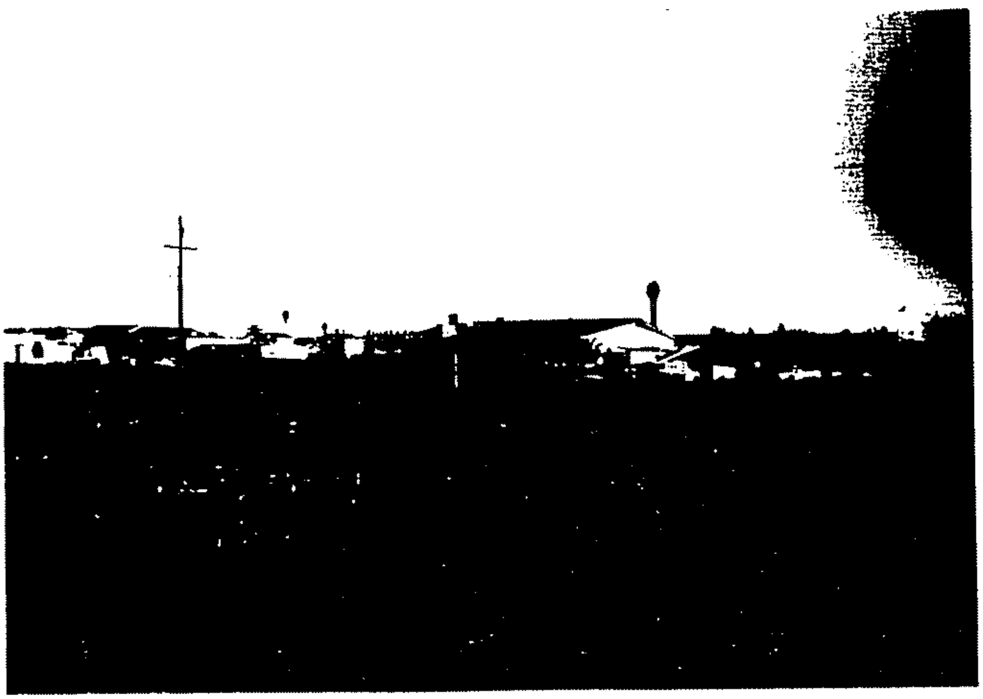


7-11 Store and Coin Laundry



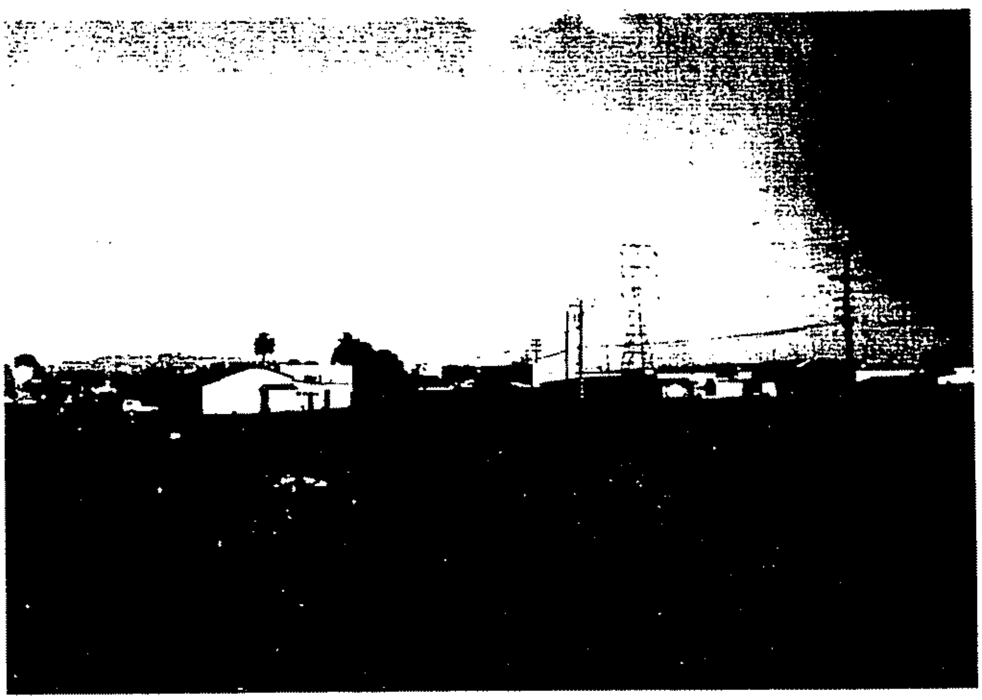
Propane tank at Sam's Trailer Service

RV dumping station at Sam's Trailer Service



Church and surrounding enclosure

Storage shed on adjacent property with evidence of previous groundwater monitoring activities



Zorilla's Restaurant overhead power lines visible

SDG&E San Diego Gas & Electric

CLAIREMONT DISTRICT OFFICE
4341 GENESEE AVENUE • SUITE 103 & 203 • SAN DIEGO CA 92117
SAN DIEGO BRANCH OFFICE
101 ASH STREET • SAN DIEGO CA 92101

FILE NO

March 20, 1990

RECEIVED MAR 2 2 1990

Ms. Theresa Hernandez
Kleinfelder
P.S.A. Department
9771 Clairemont Mesa Blvd., #G
San Diego, CA 92124

Dear Ms. Hernandez:

This letter is in response to your inquiry concerning PCB levels of San Diego Gas and Electric transformers.

San Diego Gas and Electric has never specified PCB transformers for its distribution system. Although only mineral oil transformers were purchased, some older (pre-1980) mineral oil transformers were inadvertently contaminated with PCB's by the manufacturer. Based on SDG&E's statistical sampling and testing program, it is unlikely that our equipment is PCB contaminated.

If you wish to have any of our transformers tested, there is a charge. Should any transformer be confirmed to be PCB contaminated (above 50 ppm), SDG&E will refund the payment for the particular transformer's testing.

Should you wish to make arrangements for testing, or need additional information, please call me at 495-8914.

Sincerely,

Judy Scott

Judy Scott
Energy Service Representative

JS:leb

1550 Hotel Circle North
San Diego, California 92108
(619) 294-9400
Fax: (619) 293-7920

Woodward-Clyde Consultants

February 22, 1990
Project No. 8953237N-SA02

Pacific Scene, Inc.
3900 Harney Street
San Diego, California 92110

Attention: Mr. James Moxham

ENVIRONMENTAL SITE ASSESSMENT
PALOMAR STREET AND BROADWAY
CHULA VISTA, CALIFORNIA

Gentlemen:

Woodward-Clyde Consultants (WCC) is pleased to provide this report on the environmental site assessment conducted for Pacific Scene, Inc., for the property located at Broadway and Palomar Street (see Figure 1). These services were performed in accordance with our Agreement No. 8953237P, dated December 6, 1989 and Phase II Scope of Services dated December 20, 1989, as authorized by Mr. A. James Moxham, on December 5, and 22, 1989, respectively.

WCC is pleased to have assisted Pacific Scene, Inc. with this project. Following your review of our findings, if you require additional information we can perform a more comprehensive investigation of the subject property. Ms. Jacquelyn Hams of our firm prepared this report and it was reviewed by Mr. Michael Snyder and the undersigned.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

Gary D. Clossin
Project Manager
R.E.A. 00669

GDC/JM/rlg (a/maz7)

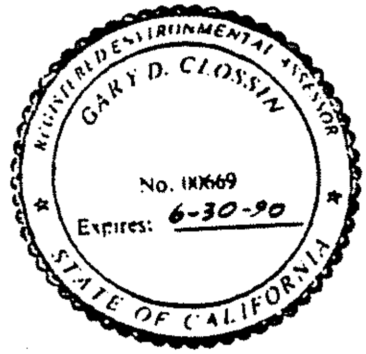


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TABLE OF CONTENTS

ENVIRONMENTAL SITE ASSESSMENT
PALOMAR STREET AND BROADWAY
CHULA VISTA, CALIFORNIA

1.0 INTRODUCTION

1.1 Project Background

Woodward-Clyde Consultants (WCC) was retained by Pacific Scene, Inc. to conduct a hazardous materials site assessment of the property located at Palomar Street and Broadway in the City of Chula Vista, California. This site assessment was performed in accordance with our Agreement Number 8953237P, dated December 6, 1989, and Phase II Scope of Services dated December 20, 1989. We understand that Pacific Scene, Inc. is interested in purchasing the 11.7-acre site for commercial development.

1.2 Project Objective and Scope of Services

The objective of the site assessment was to investigate the potential presence of hazardous substance contamination on the site as a result of past and present uses of properties in the study area.

The scope of services for the project, as outlined in the aforementioned agreement included the following tasks:

- Site Reconnaissance;
- Records Review;
- Health and Safety Plan;
- Surface Soil Sampling and Laboratory Analysis;
- Subsurface Soil Sampling and Laboratory Analysis; and
- Evaluation, Analysis, and Reporting.

1.3 Limitations

We have performed our services for this project in accordance with our Agreement, and with current professional standards for contamination assessment investigations; no guarantees are either expressed or implied. The records search was limited to information available from public sources, which are regularly changing and are frequently incomplete.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing program, implemented in accordance with a professional standard of care may fail to detect certain conditions, because they are hidden; because inferences between sampling points may differ significantly from actuality; and because observed conditions may change over time due to natural occurrences or human intervention. The scope of services that we performed is that which Pacific Scene, Inc. agreed to or selected in light of their own risk preferences and other considerations.

There is no investigation which is thorough enough to preclude the presence of materials which presently, or in the future, may be considered hazardous at the site. Because regulatory evaluation criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

Opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions. This document and the information contained herein have been prepared solely for the use of Pacific Scene, Inc. Any reliance on this report by third parties shall be at such party's sole risk.

2.0 SITE DESCRIPTION

2.1 Location

The subject property is located southwest of the intersection of Palomar Street and Broadway in the city of Chula Vista, California (Figure 1). It occupies 11.7 acres and is bound by Palomar Street to the north, the MDTB Trolley Station to the west, small businesses and vacant property to the south and a restaurant to the east.

The study area for this site assessment centers on the subject property and includes the adjacent properties (Figure 2).

2.2 Conditions

On December 11, 1989, a site reconnaissance was made by Mr. Gary Clossin and Ms. Jacquelyn Hams of WCC. WCC personnel were met at the site by Mr. Charles Iwashita, the current owner of the site, Mr. Toki Yano, realty broker for Mr. Iwashita, and Mr. James Moxham of Pacific Scene, Inc.

The site slopes to the southwest, having an elevation of approximately 50 to 60 feet MSL and appears to be elevated approximately 5 feet higher than the surrounding property, possibly due to fill introduced from the area north of the site. Evidence of soil tillage is visible on the site indicating previous agricultural usage. The current site vegetation consists mainly of cactus and tumbleweeds. Road access to the site is from Palomar Street along a dirt road, which ends near a storage shed, and from a side road east of the site. The storage shed, approximately 30 feet by 20 feet, is the only building located on the site (Photograph 1). Surface drainage is provided by a drainage ditch which runs along the southern perimeter of the site (Photograph 2). A storm drain opening is located at the southwestern boundary of the site.

2.3 Geology and Groundwater

Based on previous WCC geotechnical investigations in the surrounding area, the site is underlain by Pleistocene marine terrace sediments of the Bay Point Formation.

Regionally, the site is located within the San Diego Region Coastal Plain Section. The Coastal Plain has been dissected by various rivers to form a series of wide, flat alluvium-filled valleys. Geology of the Coastal Plain Section consists of Pleistocene marine-terrace sediments overlain by a thin cover of Quaternary alluvial deposits and underlain by the Pliocene marine San Diego Formation. The San Diego Formation is a major water producer in the area. This formation is generally greater than 1,000 feet in thickness with wells ranging from 300-800 feet in depth (Department of Water Resources, Bulletin 106-2).

A previous WCC geotechnical report indicates that the local geology at the subject site consists of a variable thickness of residual clay soils (3 to 5 feet) underlain by the Bay Point Formation, which is composed of marine sandstones, siltstones and conglomerates. Soils of the Bay Point Formation at the site consist of dense silty to clayey sand with some sandy clay.

According to the "Comprehensive Water Quality Control Plan for the San Diego Basin," prepared by the Regional Water Quality Control Board, San Diego Region (1975), the subject property lies within the Otay Hydrologic Unit, Otay Hydrologic Area. Groundwater in the Otay Hydrologic Area is designated as having existing beneficial uses for industrial applications. The potential uses include groundwater recharge applications. The depth to groundwater is approximately 50 feet, based on reported depths encountered in a formerly used irrigation well located on the subject site.

3.0 SITE USES

3.1 Historical

Our assessment of historical uses of the subject property and adjacent properties is based on review of historical aerial photographs of the area and interviews with the property owner, Mr. Charles Iwashita. The photographs reviewed cover the period from 1953 to 1989. Photographs taken during the years 1970 and 1976 highlight the major activities which occurred in the study area and are included as Figures 4 and 5.

According to the owner, in the past the site has been used for agricultural purposes; tomatoes were the main crop grown, which were replaced by cucumbers in 1980. A single celery crop was planted in 1964, but was unsuccessful. Mr. Iwashita informed WCC personnel that the following pesticides were used in the past:

- Insecticides: malathion (used most recently), Lannate (used most often for past aphid infestations), DDT, Vydate, and toxaphene (used in the 1960s);
- Herbicides: paraquat; and
- Soil fumigants: Vapam, methyl bromide and chloropicrin.

Mr. Iwashita also informed WCC that typical waste oil disposal practice was to pour it onto the ground surface in the vicinity of the storage shed, where the farm vehicles were parked.

The earliest available photographs of the site date to 1953 and showed that the site consisted mainly of cropped fields except for the northwest portion of the site where several farm houses and barns were located. The site was surrounded by cropped fields to the north and west. Mobile homes, dirt roads and an open field were located to the east and south.

By 1966, Palomar Street was a dirt road that intersected both the site location and Broadway, and was paved by 1968. The land at the present location of Ralph's displayed a slightly different agricultural pattern than the surrounding area, as if it had lain fallow or fill had been removed. By 1969, the farm houses and barns in the northwest portion of the site were absent and Ralph's building was present. Grading activities were observed on the aerial photograph at this time. Photographs taken in 1970 show the pesticide shed was present and apartments were located northeast of the site (Figure 4). The 7-Eleven convenience store and Zoralia's Mexican Restaurant and Lounge, located east of the site, were present in 1974 aerial photographs. The land just west of Ralph's at the present location of Palomar Trolley Square was still agricultural. The 1983 and 1984 aerial photographs showed more development in the area adjacent to the site; Marsat Way was complete by 1983 and the trailer courts were present south of the site. Palomar Trolley Square was complete in 1986, but the parking lot was not present until the 1987 photograph. By 1988, cars were present in the parking lot of the Palomar Trolley Square retail center and the site location did not appear to be farmed or irrigated.

3.2 Current

The site is currently undeveloped. According to Mr. Iwashita, the shed located on the site was used for storage of pesticides (Photograph 1). At the time of our reconnaissance the contents of the shed included miscellaneous containers of Chevron turbine oil (Photograph 3), Activate 3 (a wetting agent), batteries and empty fertilizer bags (Photograph 4).

One aboveground tank of approximately 500-gallon capacity used for diesel fuel, and one underground storage tank of 280-gallon capacity used for regular unleaded fuel, are located 7 feet and 3.5 feet north of the shed, respectively. Mr. Iwashita informed WCC that the underground storage tank was installed in 1970, had been empty for four years, and has not been backfilled.

A water well, used for crop irrigation, is located near the center of the site (shown on Figures 4 and 5). According to the owner, the well is estimated to be approximately 350 feet deep, contains no pump, and has not been used since June of 1986.

Four pole-mounted transformers are located on power lines which pass over the southwest edge of the site (Photograph 5). We observed no leakage from the transformer or spillage on the ground around the pole.

Palomar Street separates the site from the adjacent properties to the north; Ralph's grocery store and Palomar Trolley Square retail center (Figure 2). Zoralia's Mexican Restaurant and Lounge is located to the east of the site and the MTDB Trolley Station and parking lot is located to the west. Vacant, open land is adjacent to the site on the southwest. Sam's Trailer Service is located southeast of the site, where several old RV-trailers were stored. We observed no indications of hazardous substance mishandling during our walk-by inspection of the adjacent properties.

4.0 RECORDS REVIEW AND INTERVIEWS

During the records review portion of this site assessment, we reviewed records maintained by the following agencies (either by direct contact or via telephone or by written requests for information):

- San Diego County Tax Assessor;
- City of San Diego Water Utilities Department;
- City of Chula Vista Fire Department;
- San Diego County Department of Health Services - Hazardous Materials Management Division (HMMD);
- California Department of Health Services (DHS);
- San Diego County Department of Agriculture;
- California Regional Water Quality Control Board, San Diego Region (RWQCB); and

- United States Environmental Protection Agency (EPA).

The purpose of our records review was to assess the potential presence of hazardous substance contamination on the site and adjacent properties (Figure 2). The records search we conducted was limited to information available to us from public sources and our experience. The rationale for contacting these agencies, descriptions of the records available for review, and acronyms are presented in Appendix A. The results are discussed below.

There are three HMMD-permitted sites located within the study area; Mr. Iwashita's farm, 7-Eleven, and Buy-Rite (Figure 2). All are permitted to operate underground storage tanks. A 280-gallon underground gasoline storage tank was installed on-site in 1970. Under current regulations, the tank is exempt from tightness testing. The 7-Eleven facility is permitted to operate three 10,000-gallon fuel tanks; the tanks contain regular, unleaded, and premium gasoline. The tanks tested tight in July 1989. The Buy-Rite facility is permitted to operate three 12,000-gallon fuel tanks; the tanks contain regular, unleaded and premium gasoline. The most recent tightness test was completed in September 1988; the facility is in violation as of December 1989 for not being in compliance with testing requirements specified in the regulations. No other violations were listed for these facilities.

There are no RCRA-listed or NPDES-permitted facilities within the study area, nor facilities permitted to discharge industrial waste water to the sewer. There are no state-designated hazardous waste sites or CERCLIS-listed facilities within 1/4-mile of the site.

According to Mr. John Blocker, a supervisor with the San Diego County Department of Agriculture, there was no file on the subject site. When informed of the list of past pesticides used by the owner, Mr. Blocker indicated that lannate residues break down fairly rapidly in the soil, while residues of DDT and toxaphene can persist in the soil.

WCC spoke with Mr. Bill Breckenridge of San Diego Gas & Electric (SDG&E) to obtain further information on the electric transformers at the site location. He was specifically asked whether they were tested for polychlorinated biphenyls (PCBs) and if any history of spillage is associated with them. Mr. Breckenridge said he would send SDG&E's form letter to WCC. The letter was received on January 5, 1990 and in summary, the client would have to pay to have transformers tested for PCBs. SDG&E did not give any additional information.

5.0 POTENTIAL AREAS OF CONTAMINATION

Based on our records review, interviews, and site reconnaissance, the following potential sources of contamination were identified on-site:

- Previous on-site waste oil disposal practices along the dirt road which accesses the property;

- Pesticides used, stored and possibly disposed of on-site;

- The two fuel storage tanks located near the pesticide shed, one underground and one aboveground; and

- The (presumably) oil-filled, electric transformers.

6.0 FIELD INVESTIGATION

A subsurface investigation including test borings and soil sampling was performed at the subject site to investigate the potential presence of petroleum hydrocarbon and pesticide constituents due to fuel storage, waste oil disposal practices and pesticide usage. Surface soil samples were collected to evaluate the presence of waste oil residue and pesticides, while borings, one shallow and three deep, were advanced to evaluate the presence of petroleum hydrocarbons in the vicinity of the tanks. A health and safety plan was prepared for our field investigation in accordance with OSHA requirements (CFR1910.120) to protect workers against exposure to hazardous substances. Sampling procedures are described in Appendix B.

To evaluate the presence of waste oil residue, three surface soil samples (S-4W, S-5W and S-6W) were collected near the dirt road (see Figure 3), placed in glass jars and submitted for laboratory analysis of total recoverable petroleum hydrocarbons (TRPH) by EPA Method 418.1. The trowel was decontaminated with Alconox and deionized water between sampling locations.

To evaluate the presence of pesticide residues, three surface soil samples (S-1P, S-2P and S-3P) were collected in the vicinity of a trashy area and the pesticide storage shed, and in a former agricultural field (see Figure 3). The samples were collected from a depth of one to three inches using a stainless steel trowel, placed in a glass jar, and submitted for laboratory analysis of chlorinated pesticides (EPA Method 8080) and organophosphorous pesticides (EPA Method 8140).

Three soil borings (B-1, B-2 and B-3) were advanced around the perimeter of the underground and aboveground storage tanks to a maximum depth of 19.5 feet (see Figure 3). Due to drill rig access limitations, one hand-augered boring (B-4) was advanced between the two tanks to a maximum depth of five feet (see Figure 3). Boring locations were selected on the basis of proximity to the aboveground and underground tank locations. The borings were logged in accordance with standard classification practices (Appendix B). Soil from the borings was monitored in the field for the presence of volatile hydrocarbon constituents using the headspace techniques with an Organic Vapor Analyzer (OVA). Samples were collected from B-1, B-2 and B-3 at five-foot intervals for laboratory analysis; samples from B-4 were collected at the surface, 2.5 and 5 feet. Samples depths and OVA readings are presented on Table 1; no elevated OVA readings were recorded. A total of eight subsurface soil samples were selected for laboratory analysis of total petroleum hydrocarbons (TPH) by modified EPA Method 8015.

All samples were stored on ice and submitted to Analytical Technologies, Inc. (ATI) under standard chain-of-custody procedures for analysis.

7.0 LABORATORY ANALYSES

The laboratory analytical results are summarized on Tables 1, 2 and 3; laboratory reports and Chain-of-Custody forms are included in Appendix C.

Laboratory results of soil samples tested for organochlorine pesticides (S-1P, S-2P and S-3P) are shown on Table 1. Concentrations of toxaphene, DDT, and DDE are present above the detection limit in the samples analyzed. None of the EPA Method 8140 organophosphorous pesticides were detected in concentrations above the laboratory detection limits in surface soil samples S-1P, S-2P and S-3P. Detection limits for each compound are shown on the laboratory analyses reports in Appendix C.

Laboratory results for surface samples (S-4W, S-5W and S-6W) which were analyzed for waste oil by EPA Method 418.1 are shown on Table 2. TRPH concentrations in the three samples are 21, 210, and 13 milligrams per kilogram (mg/kg), respectively.

The results of the EPA Method 8015 analyses on the eight soil samples taken from the perimeters of the underground and aboveground storage tanks indicate that none of the soil samples exhibited TPH concentrations above the laboratory detection limit (5 mg/kg). Table 3 summarizes field data and laboratory results.

8.0 DISCUSSION

The site vicinity has a history of agricultural usage prior to the 1950s. Agricultural activity on-site was discontinued in the late 1980s; development of the surrounding properties began during the late 1960s. The two facilities within the study area (other than the site) permitted to handle hazardous substances (7-Eleven and Buy-Rite) have no record of violations or unauthorized releases. It is unlikely that hazardous substance spillage on the adjacent properties, if any, will negatively impact the site.

It appears unlikely that the on-site storage tanks have been a significant source of contamination, based on the results of the field investigation. Borings were advanced within three feet of both tanks, and a hand-augered boring was taken beneath the aboveground tank. Although the analytical results of soil borings near the area of the underground and aboveground storage tanks do not show the presence of hydrocarbons, minor amounts of contamination may be identified in the backfill soil when the underground tank is removed. The underground tank must be abandoned in accordance with current state and federal regulations.

TRPH constituents were found in the surface soil samples analyzed. This suggests that previous waste oil disposal practices on-site have resulted in residual petroleum hydrocarbons in the soil which may require remediation prior to development.

The results of the surface soil samples analyzed for pesticides indicate the presence of DDT, DDE and toxaphene. The detection of organochlorine pesticides in surface soil samples is consistent with the land's historical use for growing irrigated vegetable crops. Toxaphene and DDT are organochlorine insecticides, and DDE is a product of DDT degradation. Until the early 1970s, these insecticides were commonly used throughout California on a variety of crops, including cotton, tomatoes, celery and broccoli. With no further applications of these insecticides in the area, the soil concentrations will be expected to gradually decrease with time as the compounds degrade.

The Total Threshold Limit Concentration (TTLC) is the regulatory threshold level for defining a hazardous waste [per the California Code of Regulations, Title 22, Article 9, Section 66699(c)]. The TTLCs for DDT, DDE and toxaphene are 1.0 mg/kg, 1.0 mg/kg and 5.0 mg/kg, respectively. The three soil samples from the site had concentrations exceeding the TTLC for DDT; one sample was slightly above the TTLC for DDE (1.1 mg/kg),; and no samples exceeded the TTLC for toxaphene.

TTLCs have been established by the State of California for characterizing wastes as being hazardous or nonhazardous for disposal purposes. Off-site disposal of soil having only marginal exceedences of TTLCs, in our opinion, is not considered practical for this site, because the pesticide concentrations will continue to decrease with time. Additionally, during site development, the portion of the soil horizon in which the pesticide residues occur (upper six inches) will ultimately be mixed with uncontaminated soil, thus further reducing current pesticide concentrations.

We were unable to obtain sufficient information to rule out the possibility that the transformers located on-site were PCB-containing. According to SDG&E's response, the oil must be sampled and analyzed for PCBs. However, we observed no leakage from the transformers.

9.0 CONCLUSIONS

Based on the site history, site reconnaissance, records review, interview data and limited field investigation data collected and evaluated as part of this study, we conclude the following:

- It is unlikely that soil contamination from the underground fuel storage tank is present in quantities which would represent a significant remediation cost;
- TRPH are present in the surface soils due to waste oil disposal practices; however, results of our field investigation indicate that the extent of the contamination is localized and remediation costs are unlikely to be significant;
- Low levels of pesticide residues have been detected in the surface soils, as a result of agricultural usage of the site. Our interpretation of current regulatory criteria leads us to believe that the pesticide residues may not be present in quantities which will require remediation; and
- Our investigation could not rule out the possibility that PCB-contaminated oils are present in the transformers located on-site; however, it is our opinion that the transformers do not represent a significant issue.

10.0 RECOMMENDATIONS

Based on the results of our investigation, we recommend the following:

- Perform additional soil sampling and analysis to define the lateral and vertical extent of waste oil contamination;
- Remove the underground tank in accordance with applicable regulations; and
- Analyze the soil beneath the electrical transformer for PCB constituents.

TABLE 1

PALOMAR STREET AND BROADWAY
SUMMARY OF LABORATORY ANALYTICAL RESULTS
ORGANOCHLORINE PESTICIDES
SURFACE SOIL SAMPLES
(EPA METHOD 8080)

Sample ID	Toxaphene (mg/kg)	DDE[1] (mg/kg)	DDT[2] (mg/kg)
S-1P	1.6	0.37	0.50
S-2P	ND	0.52	1.4
S-3P	3.3	1.1	2.5

ND = Not detected (detection limit of toxaphene for sample was 2.0 mg/kg)

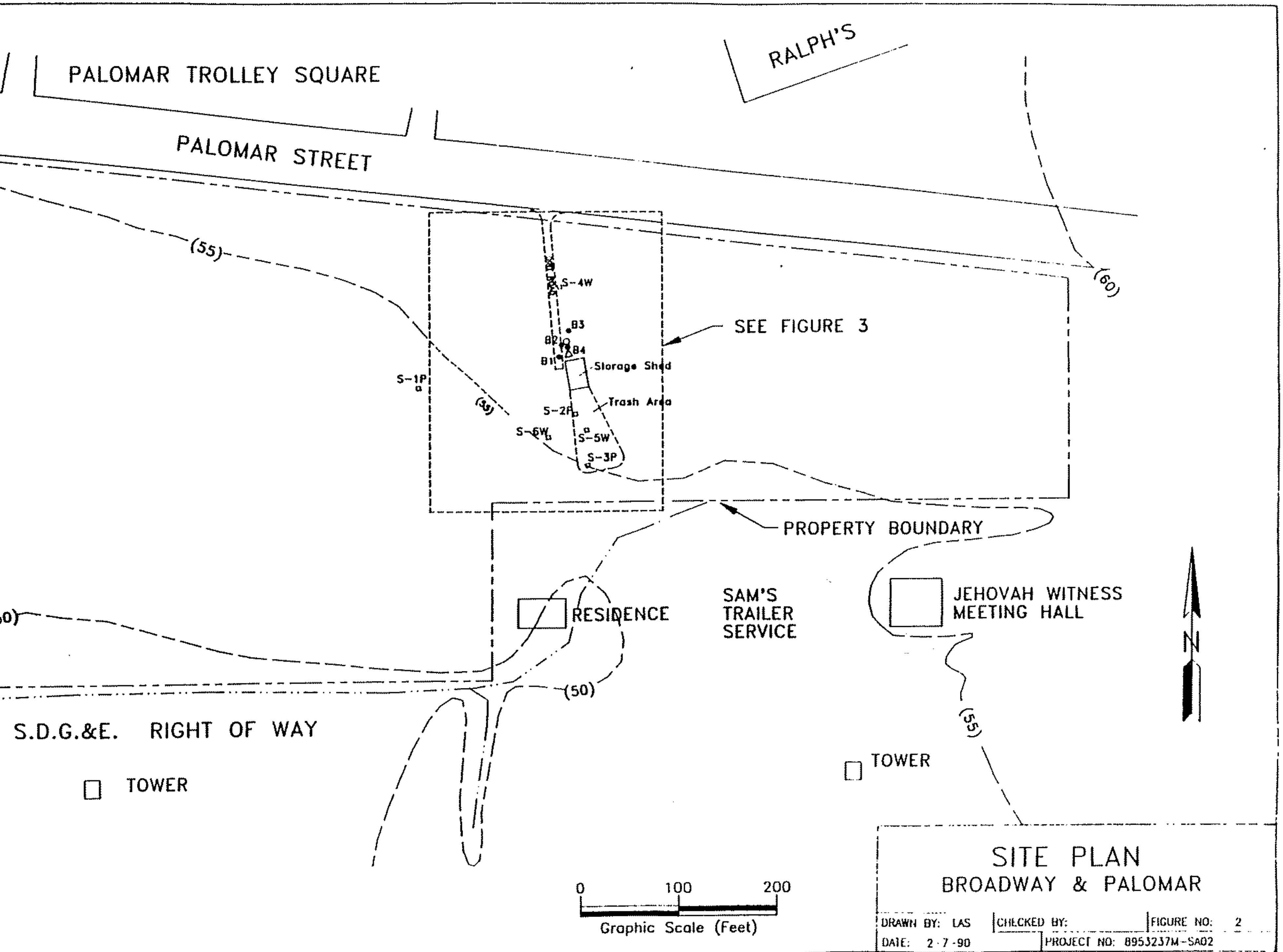
1 Para, para isomer of DDE

2 Concentrations are the sum of the para, para' isomer and ortho para isomer; for purposes of summation, non-detectable (ND) was assumed to be equivalent to 0.

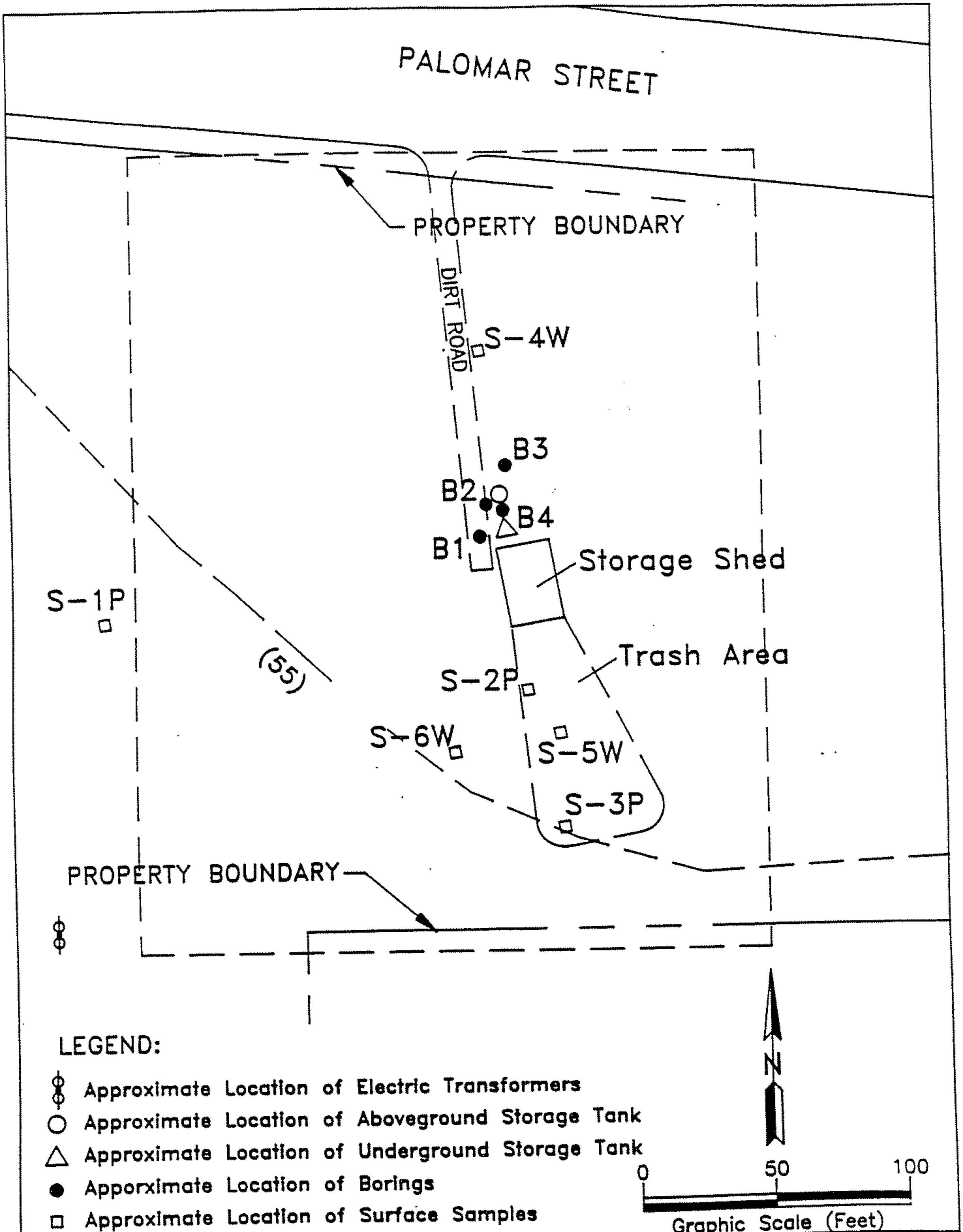
Source: 1990 Thomas Bros. Guide
San Diego County

VICINITY MAP
PALOMAR & BROADWAY

DRAWN BY: cta	CHECKED BY:	PROJECT NO: 8953237N-SA 02	DATE: 2-6-90	FIGURE NO: 1



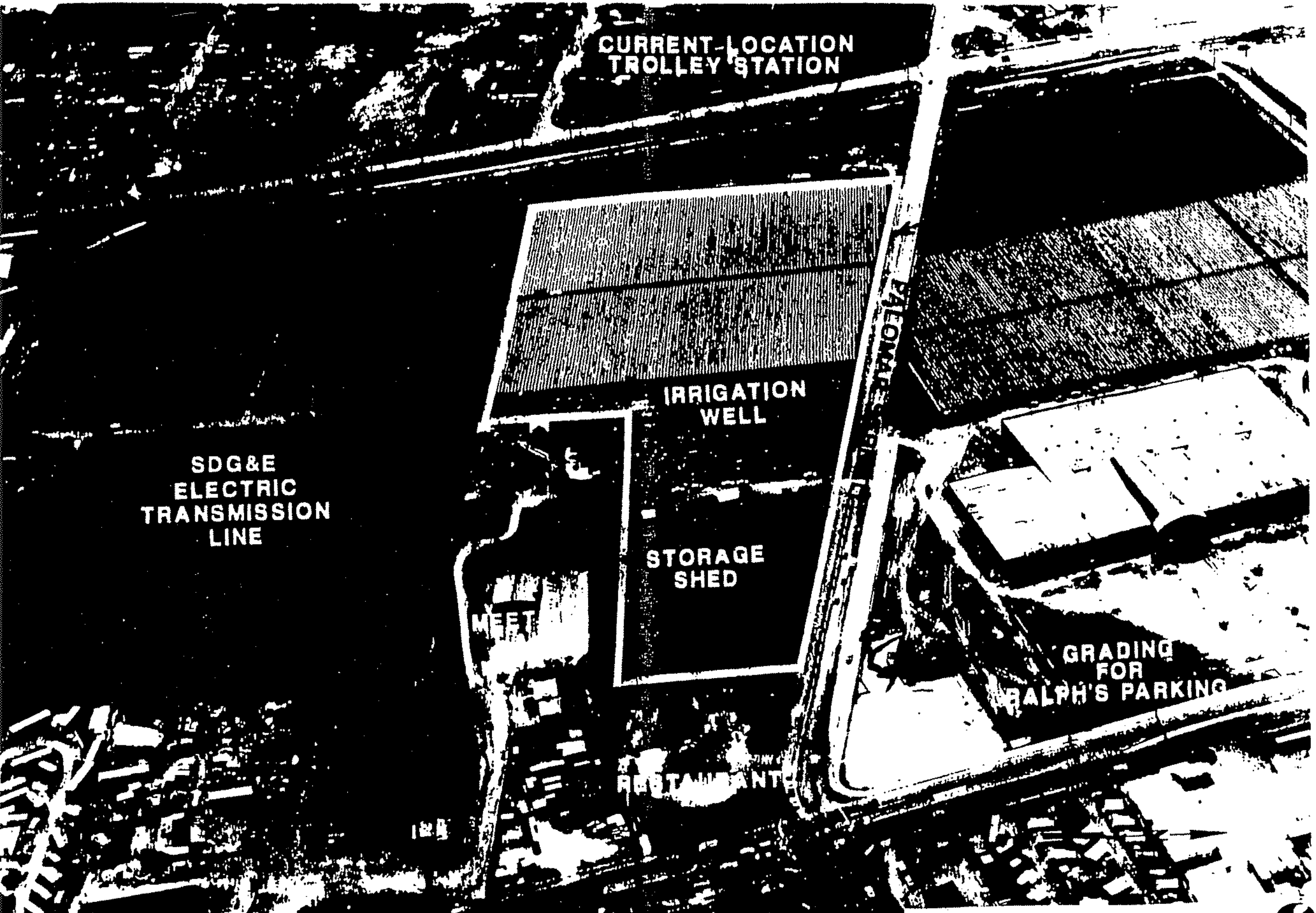
WOODWARD-CLYDE CONSULTANTS



BORING AND SOIL SAMPLE LOCATIONS MAP
BROADWAY & PALOMAR

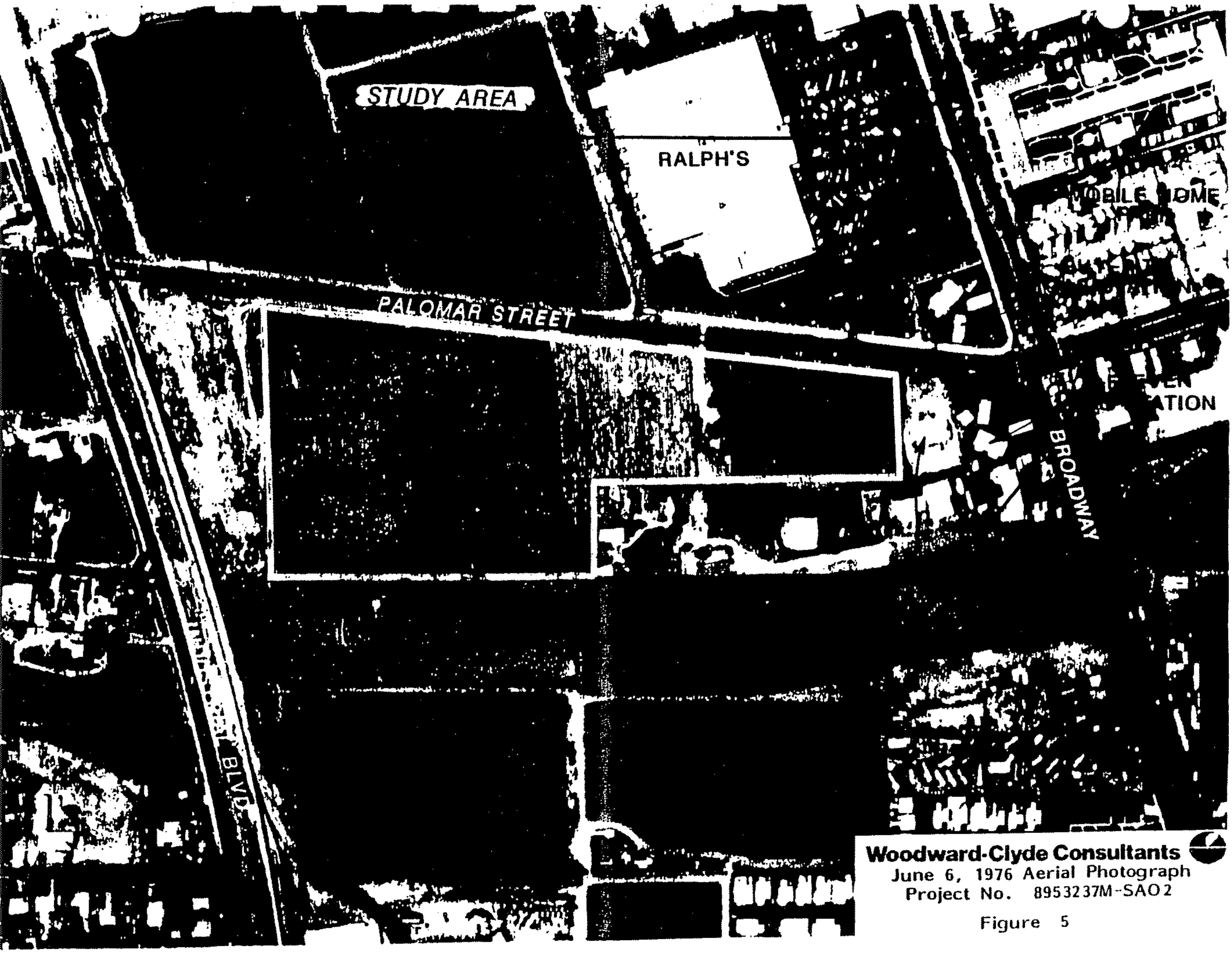
DRAWN BY: LAS	CHECKED BY: Gdc	PROJECT NO: 8953237M-SA02	DATE: 2-7-90	FIGURE NO: 3

WOODWARD-CLYDE CONSULTANTS



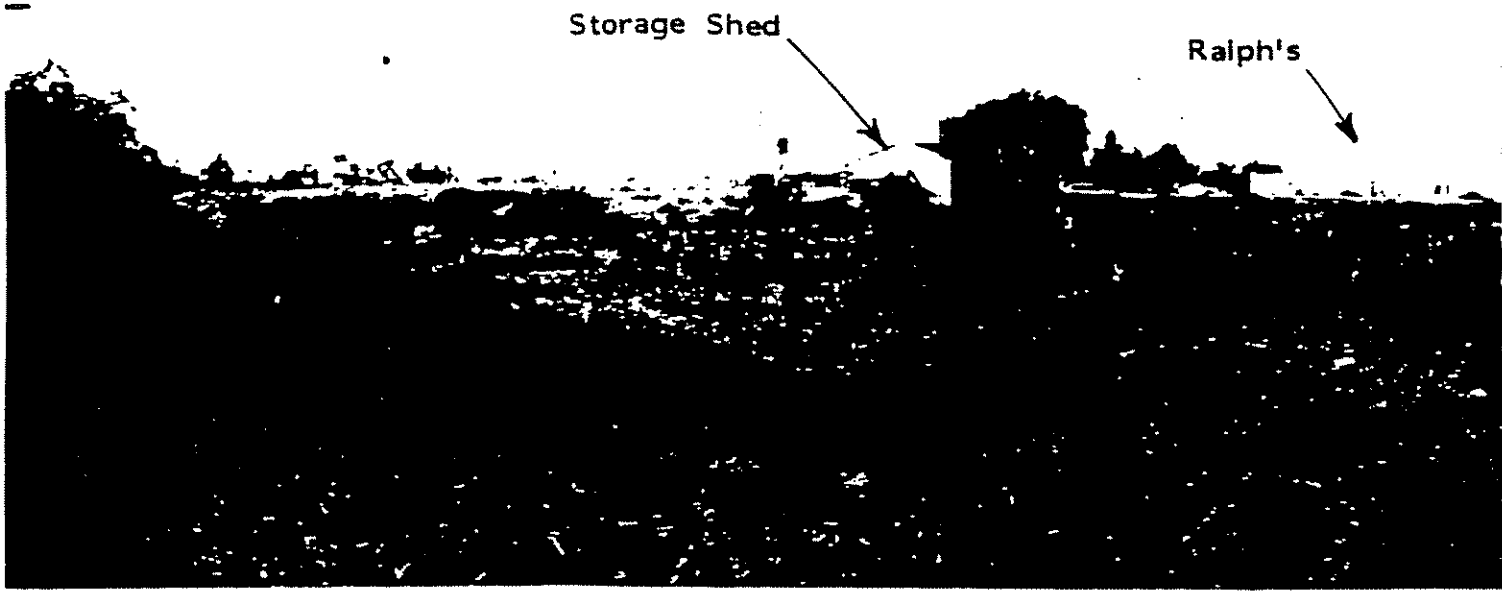
Woodward-Clyde Consultants
April 20, 1970 Aerial Photograph
Project No. 8953237M-SAO2

Figure 4

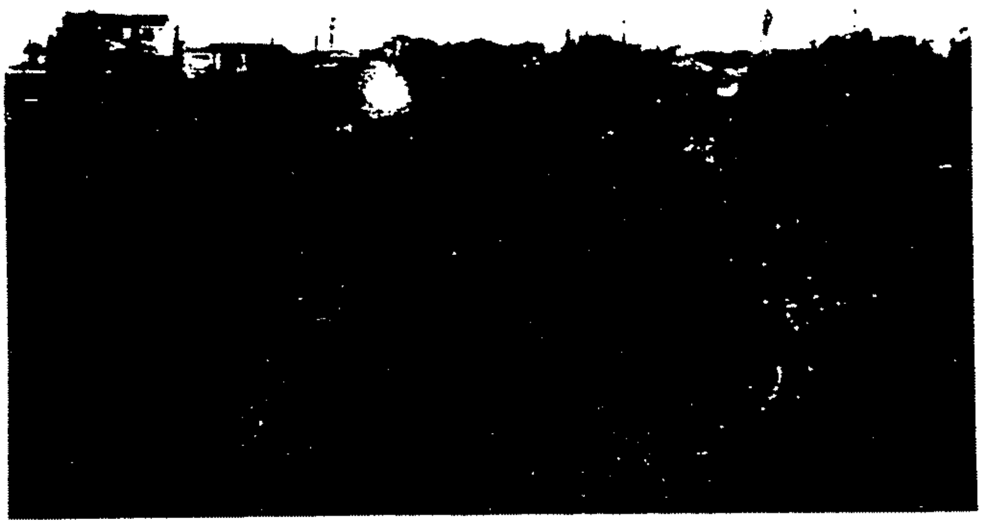


Woodward-Clyde Consultants
June 6, 1976 Aerial Photograph
Project No. 8953237M-SAO2

Figure 5



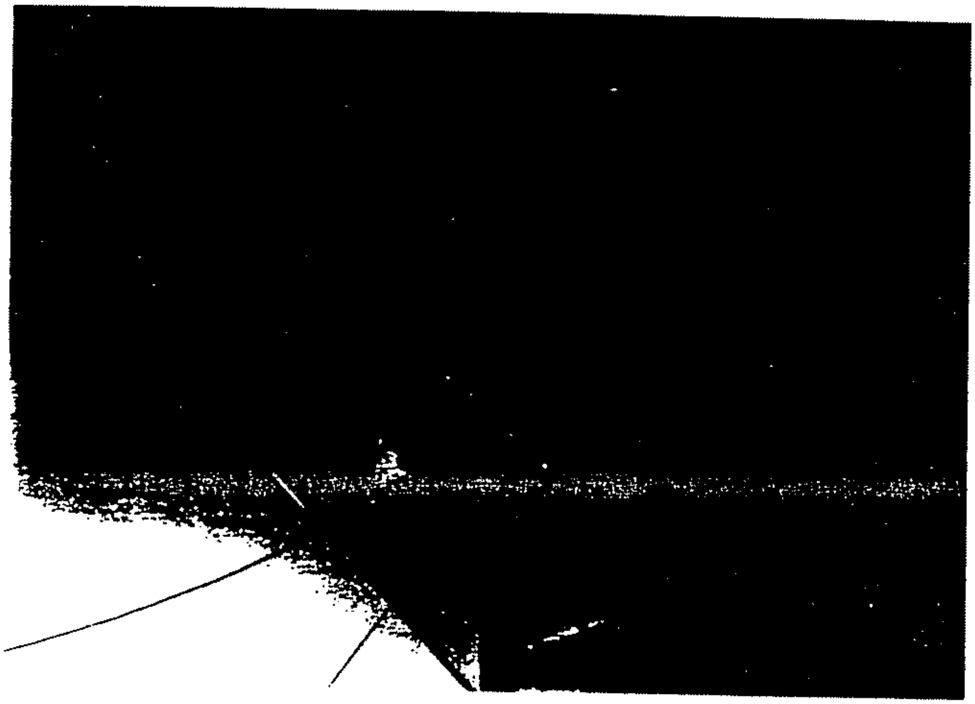
Photograph 1. View of southeast portion of site facing northwest. Storage shed is at center of the photo.



Photograph 2. (Looking west) drainage ditch near the southwest corner of the site. Notice that site is 3' to 5' higher in elevation than adjacent property to the south.

Photograph 3. Interior of storage shed.

Photograph 4. Empty pesticide container at rear of storage shed.



Photograph 5. Pole-mounted transformers located on the site.

TABLE 3

PALOMAR STREET AND BROADWAY
SUMMARY OF LABORATORY
ANALYTICAL RESULTS
FOR SOIL BORINGS
(MODIFIED EPA METHOD 8015)

Boring ID	Sample No.	Type	Fuel Hydrocarbons (mg/kg)
B-1	B1-15	Soil	ND
B-1	B1-19.5	Soil	ND
B-2	B2-5	Soil	ND
B-2	B2-19.5	Soil	ND
B-3	B3-15	Soil	ND
B-3	B3-19.5	Soil	ND
B-4	B4-Surface	Soil	ND
B-4	B4-5	Soil	ND

ND = Not detected (detection limit is 5.0 mg/kg)

TABLE 2

PALOMAR STREET AND BROADWAY
SUMMARY OF LABORATORY ANALYTICAL RESULTS
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
SURFACE SOIL SAMPLES
(EPA METHOD 418.1)

Sample ID	Petroleum Hydrocarbons (mg/kg)
S-4W	21
S-5W	210
S-6W	13

APPENDIX A

RECORDS REVIEW - RATIONALE AND METHODOLOGY

APPENDIX A

RECORDS REVIEW - RATIONALE AND METHODOLOGY

The purpose of the records review was to assess the potential presence of hazardous substance contamination on the site. The records search was limited to information available to us from public sources and previous project experience. The public sources are updated regularly, but are frequently incomplete. During the records review, we engaged in telephone consultation with public agencies, made written requests for agency information and reviewed records at the following agencies:

- San Diego County Tax Assessor;
- City of San Diego Water Utilities Department;
- City of Chula Vista Fire Department;
- San Diego County Department of Health Services - Hazardous Materials Management Division;
- California Department of Health Services;
- San Diego County Department of Agriculture;
- California Regional Water Quality Control Board, San Diego Region; and
- U.S. Environmental Protection Agency.

The rationale for contacting each agency during our records review are discussed in the following paragraphs.

<u>San Diego County Tax Assessor</u>

We reviewed maps and records from the San Diego County Tax Assessor to identify parcel designation numbers and current property ownership. Street address listings were obtained for businesses in the study area. This information was used at the City of San Diego and County Department of Health Services to identify current business uses.

<u>City of San Diego Water Utilities Department</u>

The City of San Diego has been responsible for issuing Industrial User Discharge permits for most of the cities throughout San Diego County since 1978. The listing of permits is reviewed to assess whether there are industries within the study area may be a potential source of contamination due to hazardous waste leakage from the sewer system. The permitted facilities must submit a treatment plan to the City for approval and must operate under a permit that specifies the treatment system details and discharge conditions. The facilities are identified in the City listing by the type of industrial wastes discharged, and are categorized as follows: Category 1, toxic wastes requiring treatment prior to discharging to the sewer; Category 2, toxic wastes not requiring treatment prior to discharging to the sewer; and Category 3, nontoxic wastes (other than domestic).

City of Chula Vista Fire Department (CVFD)

The CVFD maintains microfiche files of registered underground flammable storage tanks installed in the City of Chula Vista. Information regarding the status of the tanks, including installation, abandonment and removal, is frequently incomplete, but identifies tanks not necessarily documented in the County Department of Health Services files. The CVFD files have been maintained since approximately 1985.

San Diego County Department of Health Services - Hazardous Materials Management Division (HMMD)

The available listings reviewed at HMMD are as follows:

- The Master List of Hazardous Materials Users and Hazardous Waste Generators (He10 - He58, dated October 4, 1989);
- Selected Hazardous Materials Records List of Public Disclosure, Wastes and Violations, and Underground Storage Tanks (Report He1790, dated October 4, 1989);
- Unauthorized Release Listing (dated October 4, 1989; and
- Tank Permits Information (He58, dated October 4, 1989).

The Master Listing (He10-He58) is a compilation of facilities which are under permit by the HMMD as users of hazardous materials or generators of hazardous waste. The records reviewed date back to 1984 which is the year the files were initiated. Nine categories are used by the HMMD to classify the permits. Three categories describe whether a facility is permitted to generate hazardous waste, store hazardous material, or both. There is a category for permitted facilities operating with underground tanks and another category for a facility that does not use or generate hazardous materials, but has underground tanks. The remaining categories refer to non-generator facilities.

Permitted facilities storing hazardous materials are required to disclose those substances stored on-site which exceed 55 gallons, 500 pounds or 200 cubic feet of gas at any time. This information is summarized in the He1790 Listing. The names of some materials are confidential and not available to the public.

The HMMD staff conduct inspections in response to complaints, incidents, and unauthorized releases. The HMMD defines an incident as a hazardous spill or investigated complaint. The listing of wastes and violations (He1790) is a compilation of field inspection findings. The HMMD is also responsible for permitting underground hazardous substance storage tanks. An unauthorized release is defined as a leak from an underground tank system and the HMMD maintains an Unauthorized Release Listing.

The Tank Permits Information (He58) is a compilation of facilities with permitted underground storage tanks. This listing includes information on the number of tanks, capacity, contents, monitoring system, regulatory status, test status, inspection status, test date, and inspection date.

California Department of Health Services (DHS)

The DHS Bond Expenditure Plan (revised January 1988) identifies hazardous waste sites within the State of California targeted to be cleaned up by responsible parties, the DHS , or the United States Environmental Protection Agency in the next five years. The Bond Expenditure Plan also includes a listing of hazardous waste sites in California which are included or are proposed sites meeting the criteria for being listed on the United States National Priorities List (NPL).

The Abandoned Sites Program Information System (ASPIS) is a database maintained by the DHS Toxic Substance Control Division. Information from the ASPIS is compiled in a "Facility Profile Report" which indicates current site status. Site status is divided into six categories including known Superfund sites, unresolved sites which investigations are required to determine contamination, sites scheduled for future investigation, sites referred to Toxic Substance Control Division enforcement unit for follow-up, sites currently under investigation or mitigation, and sites lacking information or indications of contamination.

San Diego County Department of Agriculture

The Chula Vista office of the San Diego County Department of Agriculture has decades of experience in the San Diego area related to plant disease and pesticide application. Field inspectors are contacted to determine if a site has been formerly used agriculturally, and if so, what crops and farming methods might have been utilized. Quite often, knowledge of likely insecticide or herbicide usage can be obtained from County Agriculture personnel.

California Regional Water Quality Control Board, San Diego Region (RWQCB)

The San Diego RWQCB is the monitoring agency for National Pollutant Discharge Elimination System (NPDES) permits in San Diego. NPDES permits regulate the release of pollutants which will ultimately enter surface waters in the United States. The release of wastes into area storm drain systems could be a possible source of contamination to adjacent areas. RWQCB also maintains records of underground fuel tank cases and unauthorized releases; these records are reviewed as a check on the HMMD files.

U.S. Environmental Protection Agency (EPA)

The Resource Conservation and Recovery Act (RCRA) database was reviewed to see if any of the facilities in the subject study area were RCRA permitted facilities. The RCRA database is a computer generated list maintained by the EPA of hazardous material facilities in the United States. The database indicates whether hazardous wastes are generated, treated or disposed of at a facility or whether the facility is involved in the transportation of hazardous wastes. The RCRA database (dated October 11, 1989) was reviewed to determine whether there are any RCRA-permitted facilities within 1/4-mile of the subject site.

A computer database of abandoned or inactive dumpsites called the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) has been regenerated by the EPA in connection with the Superfund program. This database is maintained by the EPA and is a master listing of potentially hazardous, abandoned or inactive sites. The CERCLIS database is reviewed to evaluate whether there are any facilities within 1/4-mile of the subject site that are identified by the EPA as potentially hazardous, abandoned, or inactive sites.

APPENDIX B

FIELD INVESTIGATION

APPENDIX B

FIELD PROCEDURES AND BORING LOGS

Three soil borings (B-1, B-2, and B-3) were advanced to depths of 21, 20, and 21 feet, respectively, on January 4, 1990. A fourth shallow boring (B-4) was advanced to a maximum depth of five feet. Prior to drilling the locations were surveyed using Utility Services Alert and a commercial utility location service. A truck mounted drill rig with six-inch diameter hollow-stem augers was used for drilling and sampling the borings.

The borings were sampled at approximately five-foot intervals from a depth of five feet to a maximum depth of approximately 20 feet. Soil samples were collected using a modified California split spoon sampler with stainless steel tubes. Specific sampling intervals are indicated on the boring logs. Soil samples were visually logged in the field using the Unified Soil Classification System. The sample barrel was decontaminated with Alconox solution, and rinsed twice with distilled water between each sampling interval. The hollow-stem augers were decontaminated with heated, high-pressure water between soil borings. Drill cuttings were placed in DOT 17H 55-gallon drums, sealed, labeled, and stored on-site pending analytical laboratory results.

Soil samples were monitored in the field for the presence of organic vapors using a Century Model 108 organic vapor analyzer (OVA) calibrated to methane. Headspace measurements were performed by placing a sample of soil in a resealable plastic bag. The plastic bag was sealed, and the sample was disaggregated and allowed to equilibrate in the air space (headspace) for approximately three to five minutes. A corner of the plastic bag was then opened and the OVA probe was inserted into the top of the bag. The OVA display, in ppm, was observed until an approximately stable reading was obtained and this value was recorded on the boring log.

Stainless steel tubes containing soil samples for laboratory analysis were sealed, labeled, and stored in an insulated cooler with ice during transport under WCC chain-of-custody procedures to Analytical Technologies, Inc. (ATI) in San Diego, California.

Project: PALOMAR STREET & BROADWAY	KEY TO LOGS

Date Drilled:	Water Depth:	Measured:
Type of Boring:	Type of Drill Rig:	Hammer:

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*

Surface Elevation:

0

DISTURBED SAMPLE LOCATION
Sample was obtained by collecting cuttings in a bag.

DRIVE SAMPLE LOCATION
Sample with recorded blows per foot was obtained by using a Modified California drive sampler (2" inside diameter, 2.5" outside diameter). The sampler was driven into the soil at the bottom of the hole with a 140 pound hammer falling 30" inches.

5

STANDARD PENETRATION SAMPLER
Sample with recorded blows per foot was obtained using a standard split spoon sampler (1.375" inside diameter, 2" outside diameter). The sampler was driven into the soil at the bottom of the hole with a 140 pound hammer falling 30 inches.

10

Fill

Sand

Clay

15

Silt

Sand/Clay

Silt/Sand

20

Silt/Clay

Gravel

Sand/Gravel

25

*GS - Grain Size Distribution Analysis
LL - Liquid limit
PI - Plasticity Index
LC - Laboratory Compaction Test
UBC - UBC Expansion Index
ST - Swell Test
DS - Direct Shear Test
UC - Unconfined Compression Test (psf)

30

Project No: 8953237N-SA02	Woodward-Clyde Consultants	Figure: B-1

Project: PALOMAR STREET & BROADWAY	Log of Boring No: 1

Date Drilled: 1/4/90 | Water Depth: Dry | Measured: At time of Driling
Type of Boring: 8" H.S.A. | Type of Drill Rig: CME 55 | Hammer: 140 lbs.
Logged By: J. Hams | Checked By: M. Schmoll
* see Key to Logs, Fig. B-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation:			
0	1-1	11	**RESIDUAL CLAY** Stiff, moist, dark brown, silty lean clay (Cl			OVA=0
			Becoming brown			
5	1-2	20	**BAY POINT FORMATION** Hard, moist, reddish brown, silty lean clay (CL			OVA=0
			Gravels at 8			
10	1-3	73	Very dense, moist, light brown, poorly graded sand (SP) with gravel			OVA=0
			Abundant gravels 10' - 13'			
15	1-4	87	Very dense, moist, gray, clayey sand (SC			OVA=0
20	1-5	68	Very dense, moist, light yellowish brown, silty fine sand (SM			OVA=0
			Bottom of Boring at 21 feet			
25						
30						

Project: PALOMAR STREET & BROADWAY	Log of Boring No: 2

Date Drilled: 1/4/90
Water Depth: Dry
Measured: At time of drilling
Type of Boring: 8" H.S.A.
Type of Drill Rig: CME 55
Hammer: 140 lbs.
Logged By: J. Hams
Checked By: M. Schmoll
* see Key to Logs, Fig. B-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation:			
0	2-1	9	**RESIDUAL CLAY** Stiff, moist, dark brown, silty lean clay (Cl			OVA =0
5	2-2	17	**BAY POINT FORMATION** Very stiff, moist, reddish brown, silt to lean clay (ML-CL) interbedded with, moist, light brown, silty sand (SM)			OVA =0
10	2-3	71	Very dense, moist, yellowish brown, poorly graded sand (SP), with gravel, with interbeds of sandy to clayey gravel (GM-GC)			OVA =0
15	2-4	85	Hard, moist, light gray, fat clay (CH) with brown iron oxide stainir			OVA =0
	2-5	49	Hard, moist, olive gray-brown, silty lean clay (Cl			OVA =0
20			Bottom of Boring at 20 feet			
25						
30						

Project No: 8953237N-SA02 | **Woodward-Clyde Consultants** | Figure: B-3

Project: PALOMAR STREET & BROADWAY	Log of Boring No: 3

Date Drilled: 1/4/90	Water Depth: Dry	Measured: At time of drilling
Type of Boring: 8" H.S.A.	Type of Drill Rig: CME 55	Hammer: 140 lbs.
Logged BY: J. Hams	Checked by: M. Schmoll	

* see Key to Logs, Fig. B-1

Depth, ft	Samples	Blows/ft	Material Description	Moisture Content, %	Dry Density, pcf	Other Tests*
			Surface Elevation:			
0	3-1	15	**RESIDUAL CLAY** Stiff, moist, dark brown, lean clay (CL			
5	3-2	13	**BAY POINT FORMATION** Very stiff, moist, reddish brown, silty,lean clay (Cl			OVA=0
10	3-3	21	Medium dense, very moist, light yellowish brown, poorly graded sand (SP)			OVA=0
15	3-4	68	Hard, moist, olive gray, silty lean clay (CL) with brown iro oxide staining			
20	3-5	46	Hard, moist, gray brown, clayey silt (MH			
			Bottom of Boring at 21 feet			
25						
30						

Project No: 8953237N-SA02 | Woodward-Clyde Consultants | Figure: B-4

APPENDIX C

LABORATORY REPORTS AND CHAIN-OF-CUSTODY FORMS

AnalyticalTechnologies,Inc. Corporate Offices 5550 Morehouse Drive San Diego, CA 92121 (619) 458-9141

ATI I.D. 001053

January 29, 1990

Woodward-Clyde Consultants
1550 Hotel Circle North
San Diego, California 92108

Project No.: 8953237N-SA02

Project Name: Broadway & Palomar

Attention: Joe Michalowski/Gary Clossin

On January 5, 1990, Analytical Technologies, Inc. received twenty-four soil samples for analyses. Fourteen samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference.

The results of these analyses and the quality control data are enclosed.

Marcilen Lindsey
Marcilen Lindsey
Senior Project Manager

Richard M. Amano
Laboratory Manager

ML:em

Analytical Technologies, Inc.

ATI I.D. 001053

ANALYTICAL SCHEDULE

CLIENT: WOODWARD-CLYDE CONSULTANTS
PROJECT NAME: BROADWAY & PALOMAR

PROJECT NO.: 8953237N-SA02

ANALYSIS	TECHNIQUE	REFERENCE/METHOD
PETROLEUM HYDROCARBONS	IR	EPA 418.1 (MODIFIED)
ORGANOCHLORINE PESTICIDES AND PCBs	GC/ECD	EPA 8080
ORGANOPHOSPHORUS PESTICIDES	GC/FPD	EPA 8140
FUEL HYDROCARBONS	GC/FID	EPA 8015 (MODIFIED)/ CDOHS METHOD

Analytical Technologies, Inc.

CLIENT : WOODWARD CLYDE CONSULTANTS
PROJECT # : 8953237N-SAO2
PROJECT NAME : BROADWAY & PALOMAR

DATE RECEIVED : 01/05/90
REPORT DATE : 01/29/90

ATI I.D. : 001053

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	B 1-15	SOIL	01/04/90
02	B 1-19.5	SOIL	01/04/90
03	B 2-5	SOIL	01/04/90
04	B 2-19.5	SOIL	01/04/90
05	B 3-15	SOIL	01/04/90
06	B 3-19.5	SOIL	01/04/90
07	B 4-SURFACE	SOIL	01/04/90
08	B 4-5	SOIL	01/04/90
09	S-1P	SOIL	01/04/90
10	S-2P	SOIL	01/04/90
11	S-3P	SOIL	01/04/90
12	S-4W	SOIL	01/04/90
13	S-5W	SOIL	01/04/90
14	S-6W	SOIL	01/04/90
15	B 1-5	SOIL	01/04/90
16	B 1-10	SOIL	01/04/90
17	B 1-SURFACE	SOIL	01/04/90
18	B 2-10	SOIL	01/04/90
19	B 2-15	SOIL	01/04/90
20	B 3-5	SOIL	01/04/90
21	B 3-10	SOIL	01/04/90
22	B 3-SURFACE	SOIL	01/04/90
23	B 4-2.5	SOIL	01/04/90
24	B 2-SURFACE	SOIL	01/04/90

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	24

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc. GENERAL CHEMISTRY RESULTS

ATI I.D. : 001053

CLIENT : WOODWARD CLYDE CONSULTANTS
PROJECT # : 8953237N-SA02
PROJECT NAME : BROADWAY & PALOMAR

DATE RECEIVED : 01/05/90
REPORT DATE : 01/29/90

PARAMETER	UNITS	12	13	14
PETROLEUM HYDROCARBONS, IR	MG/KG	21	210	13

001053

Woodward-Clyde Consultants

CHAIN OF CUSTODY RECORD

SHIPMENT NO.: ______

PAGE 2 OF 3

DATE 1 / 19 / 90

PROJECT NAME: Broadway & Palomar

PROJECT NO.: [illegible]

Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required*
S-4W	4W	Soil	SS Spoon	9oz glass	[illegible]	[illegible]	418.1
S-5W	5W	"					418.1
S-6W	6W	"					418.1
S-3P	3P	"					8020-8140

Total Number of Samples Shipped: 4 | Sampler's Signature: [illegible]

Relinquished By:	Received By:	Date / Time
Signature [illegible] Printed Name [illegible] Company WCC Reason [illegible]	Signature [illegible] Printed Name J. Graham Company ATI	Date 1/15/90 Time 11:45am
Signature Printed Name Company Reason	Signature Printed Name Company	Date / / Time
Signature Printed Name Company Reason	Signature Printed Name Company	Date / / Time
Signature Printed Name Company Reason	Signature Printed Name Company	Date / / Time

Special Shipment / Handling / Storage Requirements:

Gary Clussin

ATI disposal

* Note — This does not constitute authorization to proceed with analysis

001053

Woodward-Clyde Consultants

CHAIN OF CUSTODY RECORD

SHIPMENT NO.:
PAGE 1 OF 2
DATE 1/4/90

PROJECT NAME: Broadway & Palomar
PROJECT NO.: 8953237N-SA02

Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required*
B1-5	B1	Soil	Mod. Calif	SS Tube	Chilled	In Ice	Archive
B1-10	B1						Archive
B1-15	B1						8015
B1-19.5	B1						8015
B1-Surface	B1						Archive
B2-5	B2						8015
B2-10	B2						Archive
B2-15	B2						Archive
B2-19.5	B2						8015
B3-5	B3						Archive
B3-10	B3						Archive
B3-15	B3						8015
B3-19.5	B3						8015
B3-Surface	B3						Archive
B4-Surface	B4		H. Auger	4 oz glass			8015
B4-2.5	B4						Archive
B4-5	B4						8015
S-1P	1		SS Spoon	9 oz glass			8080-8140
B2-Surface	B2		Mod. Calif	SS Tube			Archive
S-2P	20		SS Spoon	9 oz glass			8080-8140

Total Number of Samples Shipped: 20
Sampler's Signature: [signature]

Relinquished By:	Received By:	Date / Time
Signature [signature] Printed Name Dan Eldredge Company WCC Reason Transport to ATI	Signature [signature] Printed Name [illegible] Company ATI	Date 1/5/90 Time 11:45am
Signature Printed Name Company Reason	Signature Printed Name Company	Date / / Time
Signature Printed Name Company Reason	Signature Printed Name Company	Date / / Time
Signature Printed Name Company Reason	Signature Printed Name Company	Date / / Time

Special Shipment / Handling / Storage Requirements: Gary Clussin 294-9400

ATI Disposal.

* Note — This does not constitute authorization to proceed with analysis

001053 08 FPN RX

SAMPLE NO.: 27052087.01

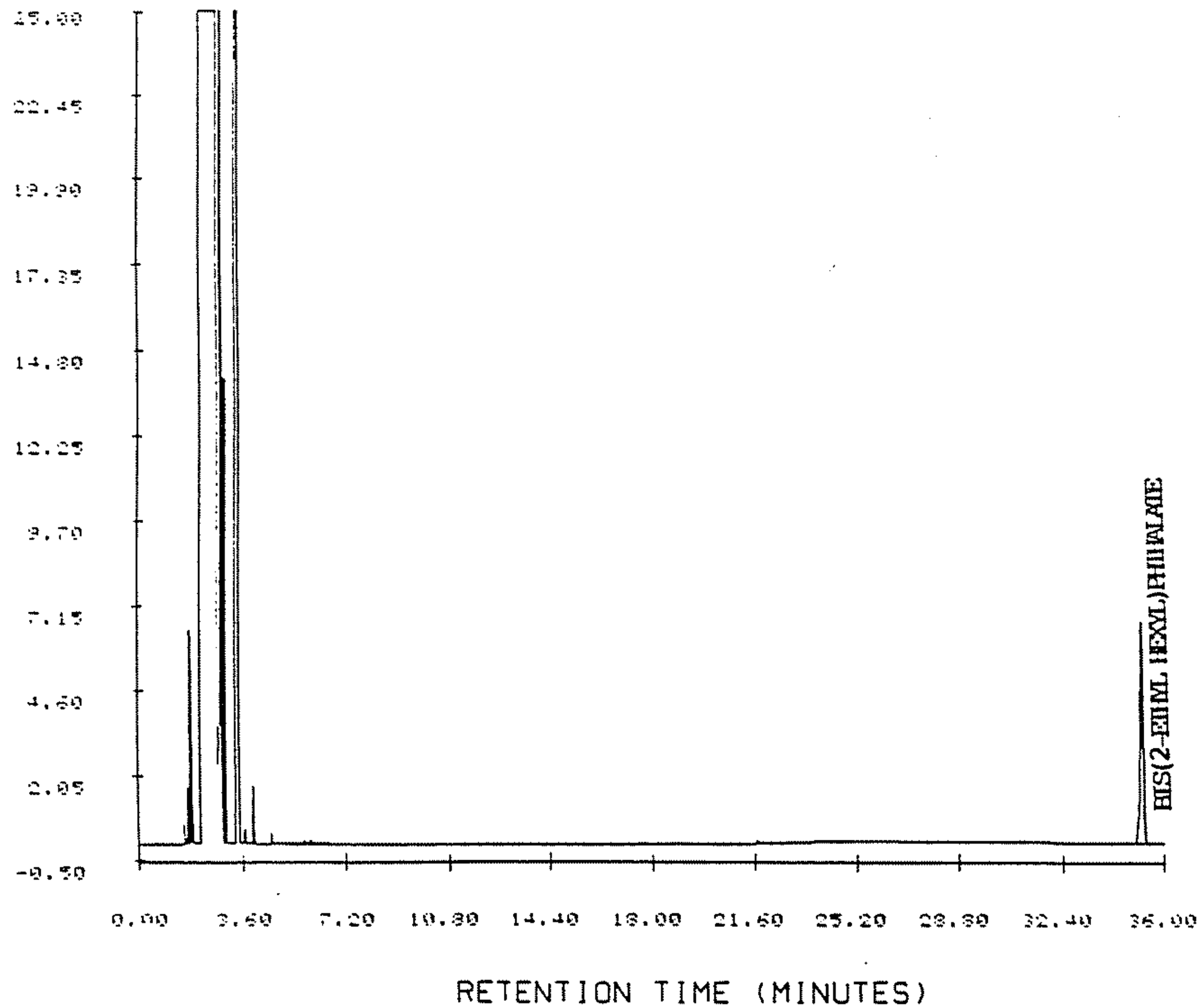
TEST NO.:

METHOD NO.: 23110 - 23110

INSTRUMENT: 23

DATE TIME: 01.13.90 08:09:59

PAGE NO.: 01



Y MAXIMUM: 25362.

Y MINIMUM: 694.

START TIME: 0.00

END TIME: 36.00

001053 07 FPN RX

SAMPLE NO.: [illegible]

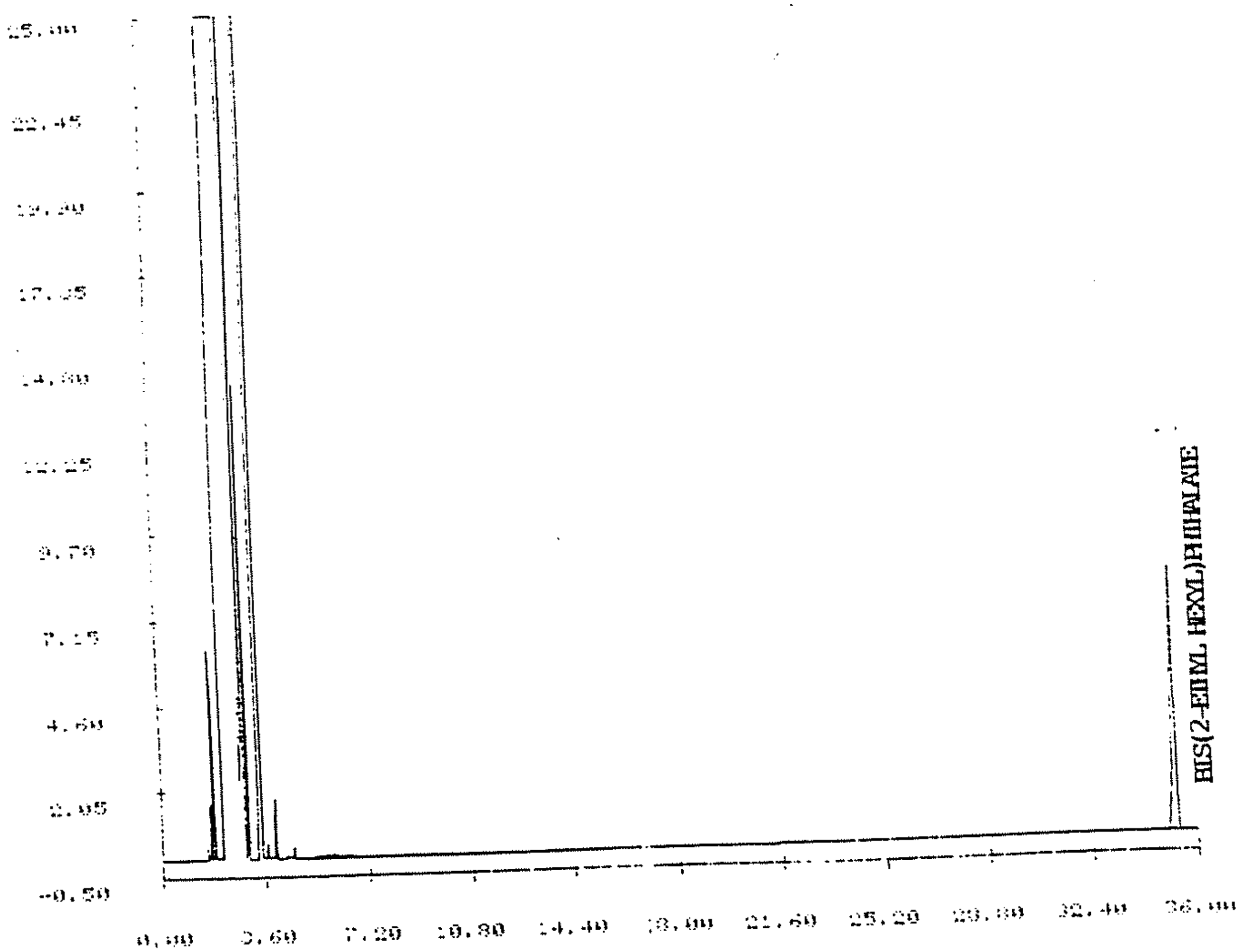
TEST NO.:

METHOD NO.: [illegible] [illegible]

INSTRUMENT: [illegible]

DATE TIME: [illegible]

PAGE NO.: [illegible]



RETENTION TIME (MINUTES)

START TIME: [illegible]

END TIME: [illegible]

MAXIMUM: [illegible]

MINIMUM: [illegible]

001053 06 FPN RX

SAMPLE NO.: [illegible]

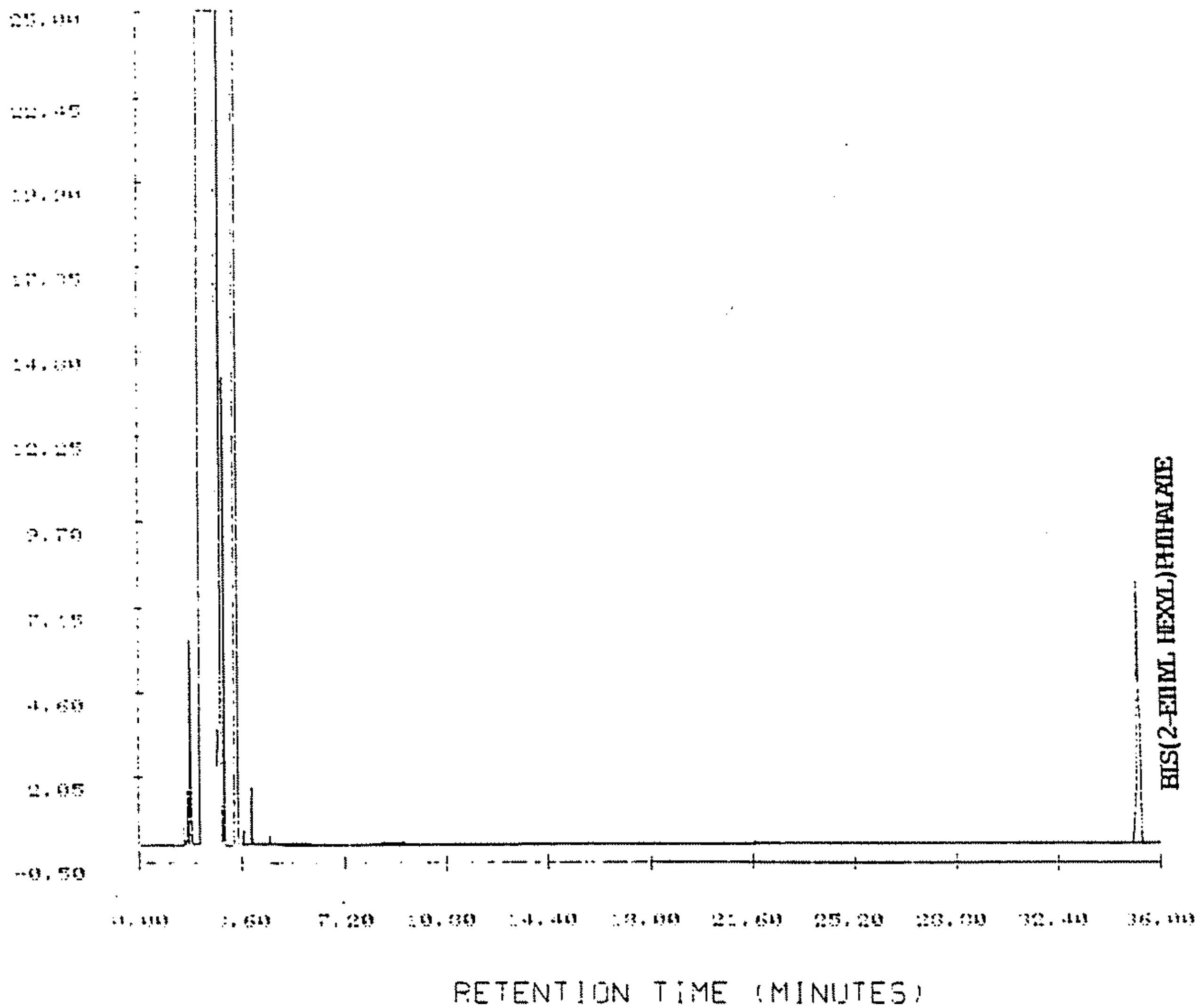
INSTRUMENT: [illegible]

TEST NO.:

DATE TIME: [illegible]

METHOD NO. [illegible]

PAGE NO.: [illegible]



Y MAXIMUM: 25360.

START TIME: 0.00

Y MINIMUM: 692.

END TIME: 36.00

0U1053 05 FPN RX

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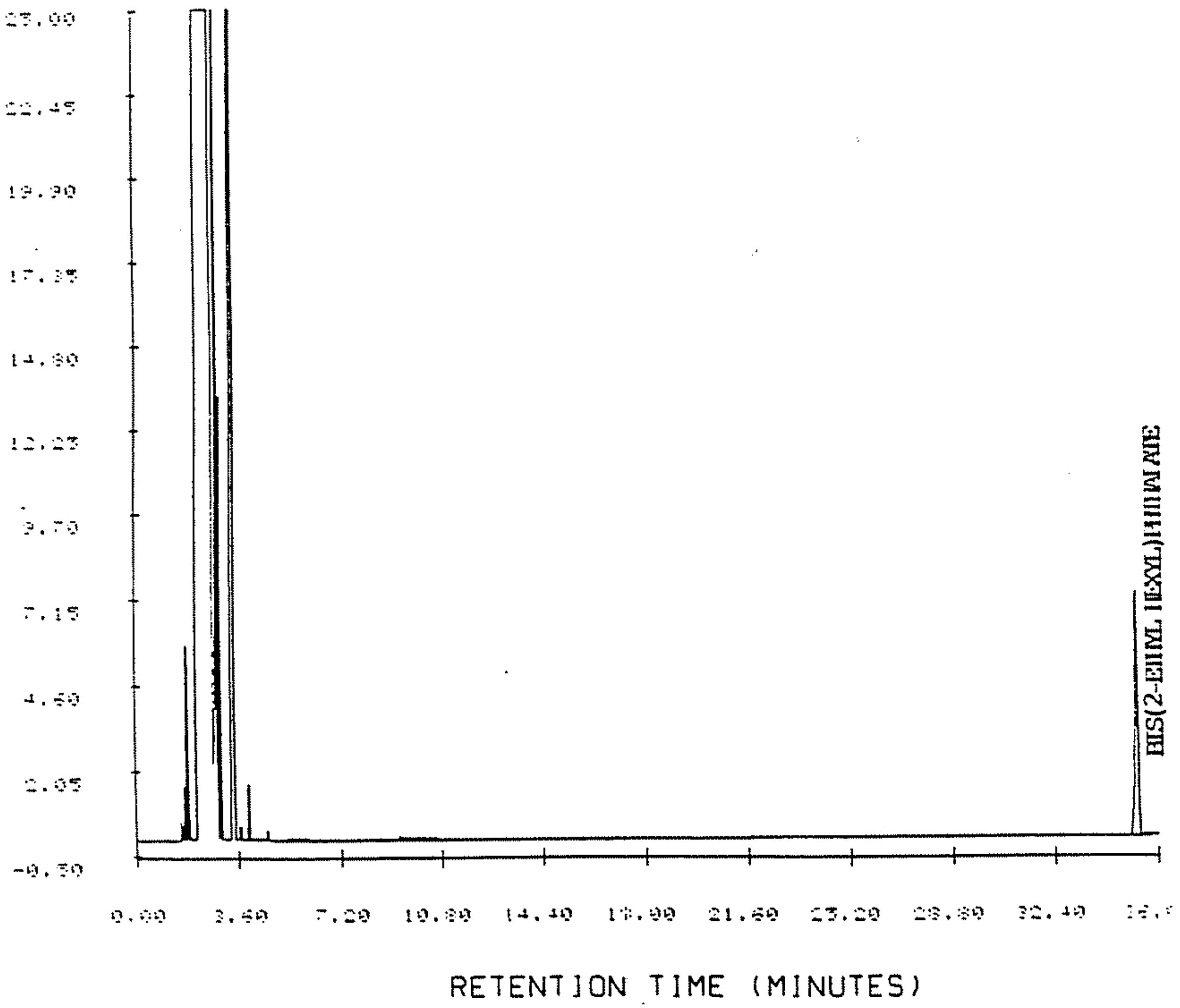
INSTRUMENT: 23

TEST NO.:

DATE TIME: 01 13 90 02:09:24

METHOD NO.: 22110 22110

PAGE NO.: 01



Y MAXIMUM: 25360.

Y MINIMUM: 692.

START TIME: 0.00

END TIME: 36.00

001053 04 FPN RX

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TEST NO.:

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INSTRUMENT: 2?

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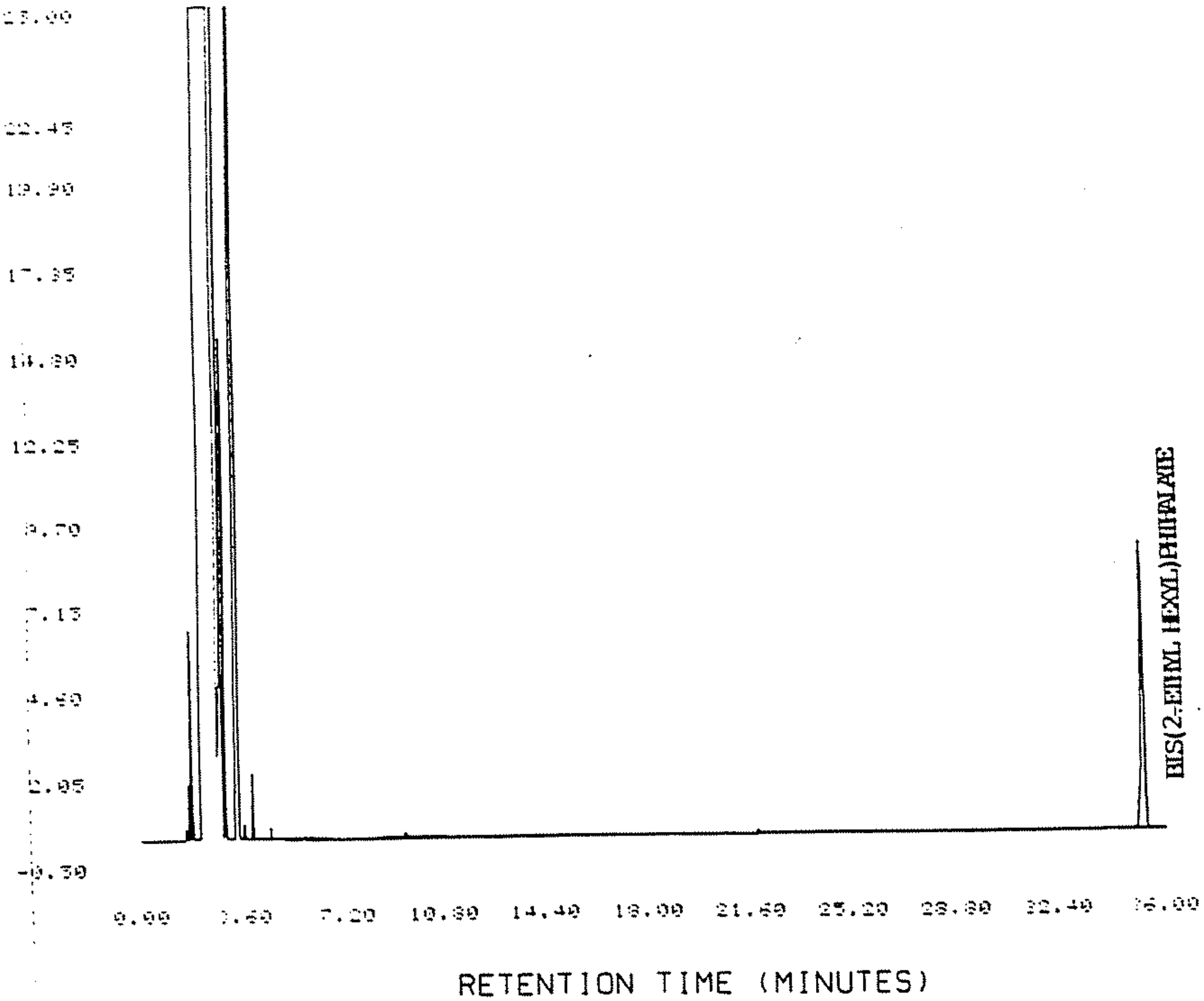
PAGE NO.: 01



Y MAXIMUM: 25339.

Y MINIMUM: 689.

START TIME: 0.00

END TIME: 36.00

001053 03 FPN RX

SAMPLE NO.: 23073027.01

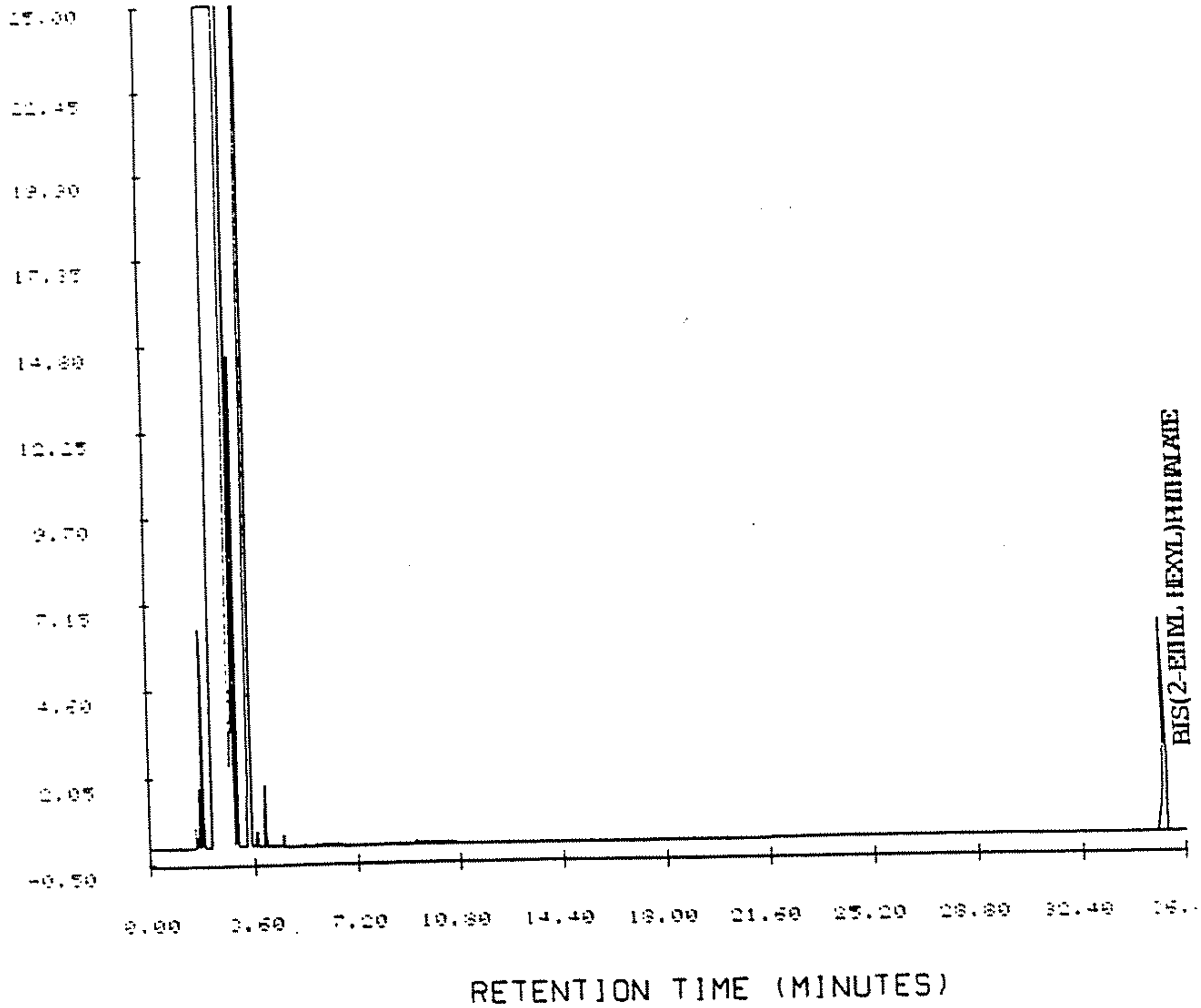
TEST NO.:

METHOD NO.: 23110 23110

INSTRUMENT: 22

DATE TIME: 01 13 90 00:32:51

PAGE NO.: 01



Y MAXIMUM: 25359.

Y MINIMUM: 691.

START TIME: 0.00

END TIME: 36.00

001053 02 FPN RX

AMPLE NO.: [illegible]

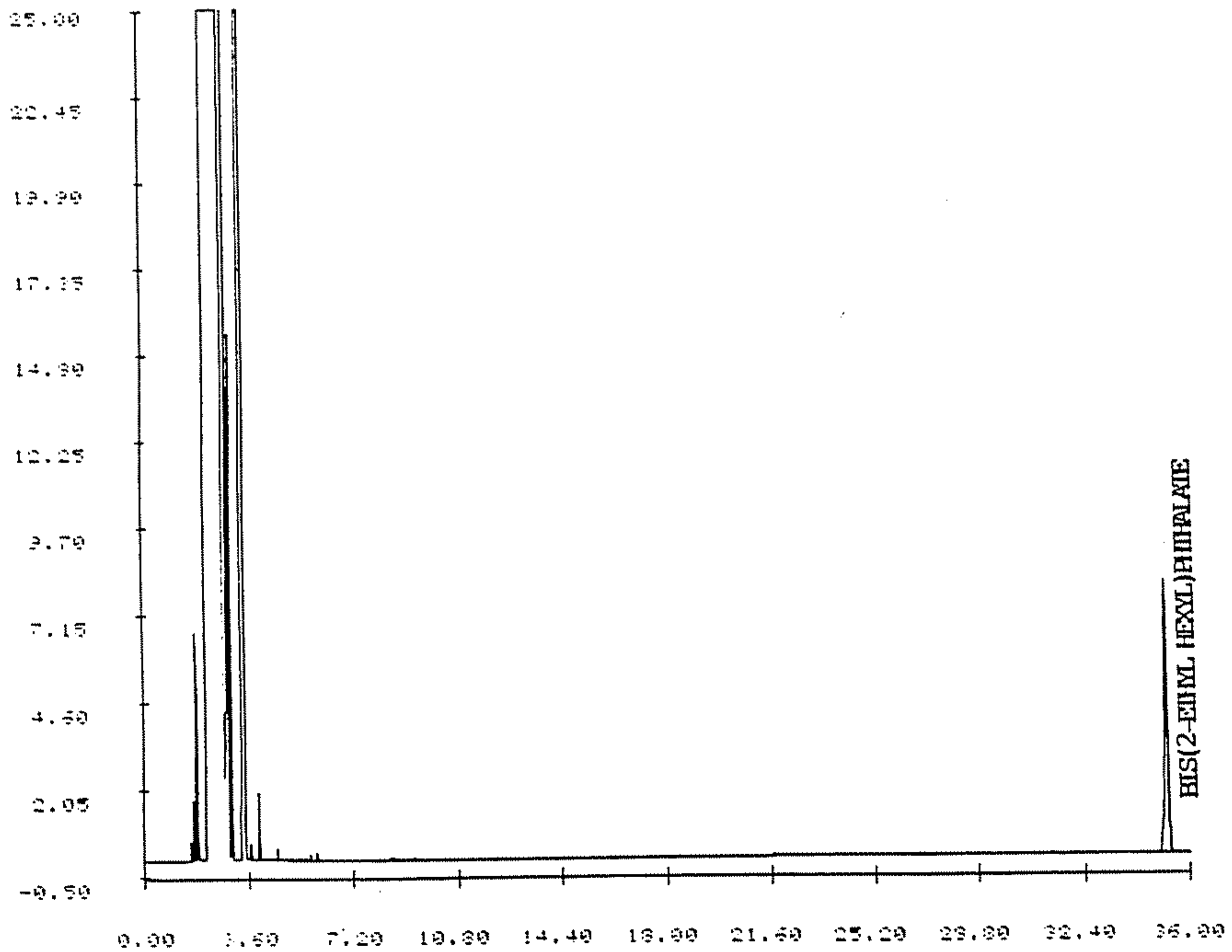
TEST NO.:

ETHOD NO.: 23110 23110

INSTRUMENT: 23

DATE TIME: 01 12 90 23:44:52

PAGE NO.: 01



RETENTION TIME (MINUTES)

Y MAXIMUM: 25360.

Y MINIMUM: 692.

START TIME: 0.00

END TIME: 36.00

001053 01 FPN RX

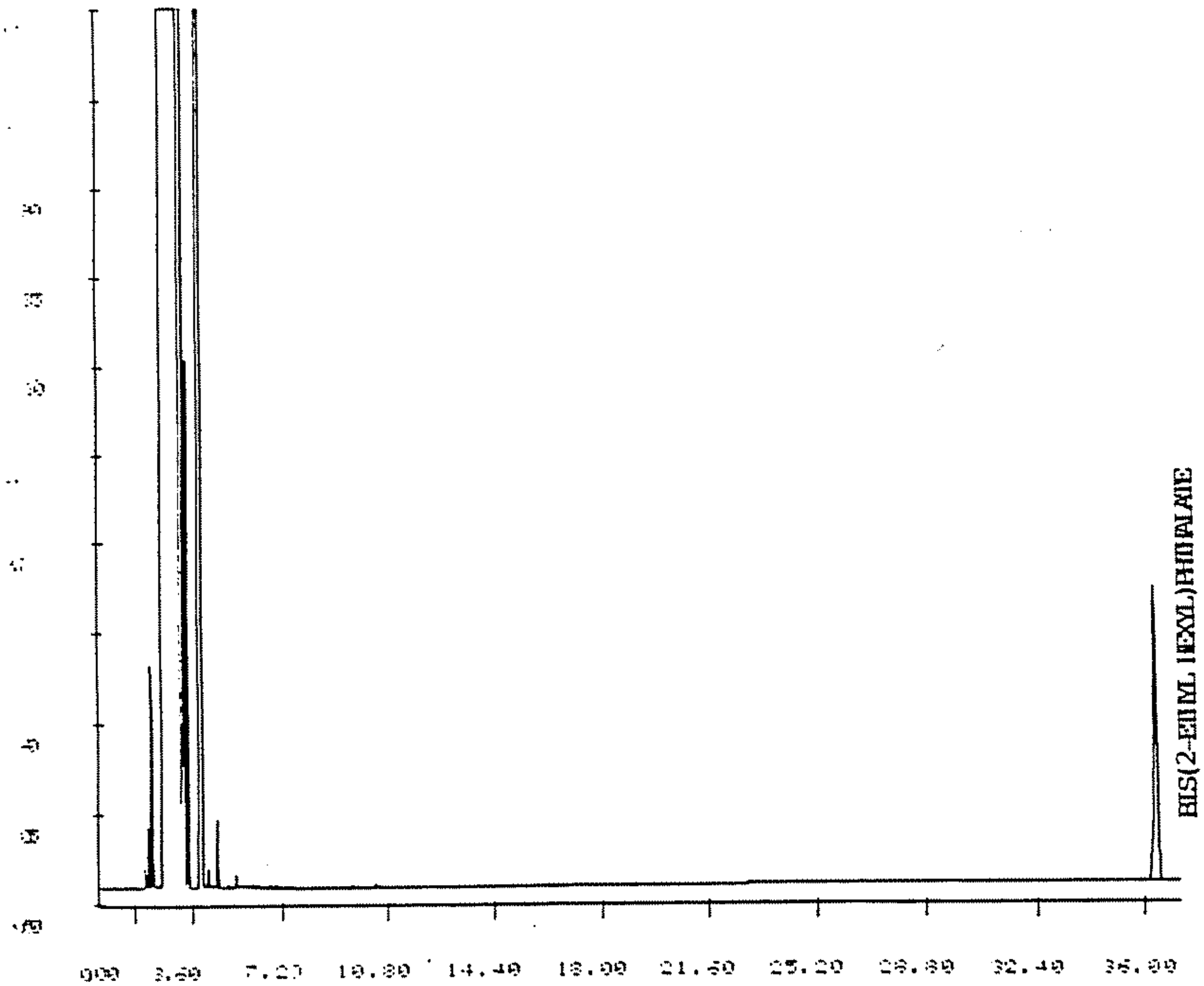
NO.: 2305101 .01

NO.: 22110 23110

INSTRUMENT: 23

DATE TIME: 01 12 90 22:56:41

PAGE NO.: 01



N : 25359.

UM: 690.

START TIME: 0.00

END TIME: 36.00

500 PPM GAS STD

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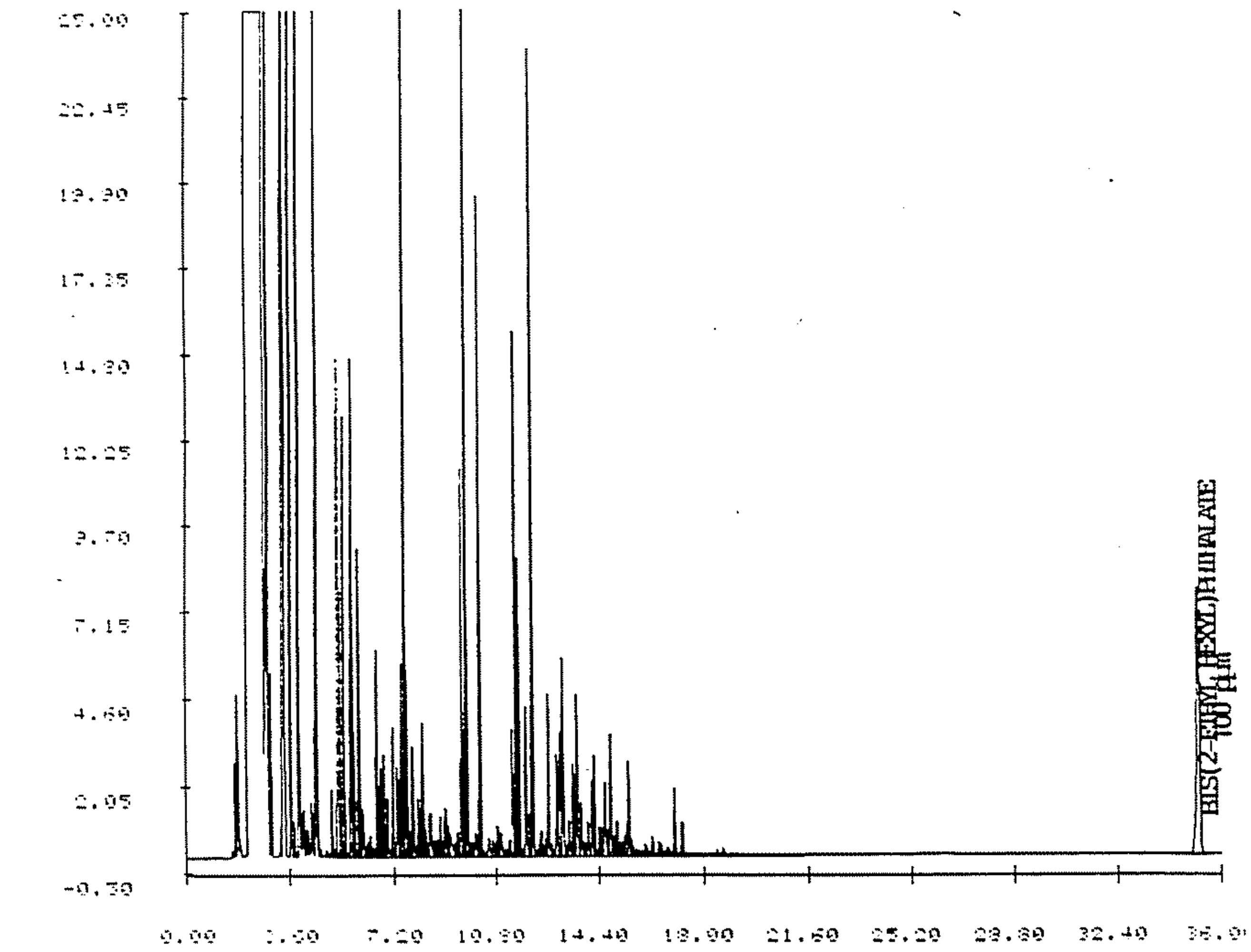
TEST NO.:

METHOD NO.: [illegible]

INSTRUMENT: [illegible]

DATE TIME: 01 12 90 00:02:[illegible]

PAGE NO.: 01



RETENTION TIME (MINUTES)

Y MAXIMUM: 25370.

Y MINIMUM: 703.

START TIME: 0.00

END TIME: 36.00

AnalyticalTechnologies,Inc.

QUALITY CONTROL DATA

ATI I.D. : 001053

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

:LIENT	: WOODWARD CLYDE CONSULTANTS		DATE EXTRACTED	: 01/05/90
PROJECT #	: 8953237N-SA02		DATE ANALYZED	: 01/13/90
ᴾROJECT NAME	: BROADWAY & PALOMAR		SAMPLE MATRIX	: SOIL
:EF I.D.	: 00105308		UNITS	: MG/KG

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
'UEL HYDROCARBONS	<5.0	500	500	100	520	104	4

$$\text{- Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105308

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: B 4-5	DATE ANALYZED	: 01/12/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5.0
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105307

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: B 4-SURFACE	DATE ANALYZED	: 01/12/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5.0
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105306

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

CLIENT : WOODWARD CLYDE CONSULTANTS
PROJECT # : 8953237N-SA02
PROJECT NAME : BROADWAY & PALOMAR
CLIENT I.D. : B 3-19.5
SAMPLE MATRIX : SOIL

DATE SAMPLED : 01/04/90
DATE RECEIVED : 01/05/90
DATE EXTRACTED : 01/05/90
DATE ANALYZED : 01/12/90
UNITS : MG/KG
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5.0
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105305

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: B 3-15	DATE ANALYZED	: 01/12/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5.0
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105304

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

CLIENT : WOODWARD CLYDE CONSULTANTS
PROJECT # : 8953237N-SA02
PROJECT NAME : BROADWAY & PALOMAR
CLIENT I.D. : B 2-19.5
SAMPLE MATRIX : SOIL

DATE SAMPLED : 01/04/90
DATE RECEIVED : 01/05/90
DATE EXTRACTED : 01/05/90
DATE ANALYZED : 01/12/90
UNITS : MG/KG
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5.0
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105303

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

LIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
ROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
LIENT I.D.	: B 2-5	DATE ANALYZED	: 01/12/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

OMPOUNDS	RESULTS
UEL HYDROCARBONS	<5.0
YDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105302

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: B 1-19.5	DATE ANALYZED	: 01/12/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5.0
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105301

TEST : MOD EPA 8015-CDOHS (FUEL HYDROCARBONS)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: B 1-15	DATE ANALYZED	: 01/12/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5.0
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

AnalyticalTechnologies,Inc.

QUALITY CONTROL DATA

TEST : EPA 8140 (ORGANOPHOSPHORUS PESTICIDES)

ATI I.D. : 001053

CLIENT : WOODWARD CLYDE CONSULTANTS
PROJECT # : 8953237N-SA02
PROJECT NAME : BROADWAY & PALOMAR
REF I.D. : REAGENT SOIL

DATE EXTRACTED : 01/05/90
DATE ANALYZED : 01/20/90
SAMPLE MATRIX : SOIL
UNITS : MG/KG

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
DIAZINON	<0.033	0.40	0.42	105	N/A	N/A	N/A
METHYL PARATHION	<0.033	0.33	0.41	124	N/A	N/A	N/A
GUTHION	<0.17	0.67	0.66	98	N/A	N/A	N/A
ETHYL PARATHION	<0.033	0.37	0.40	108	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

AnalyticalTechnologies,Inc.

QUALITY CONTROL DATA

ATI I.D. : 001053

TEST : EPA 8140 (ORGANOPHOSPHORUS PESTICIDES)

'LIENT : WOODWARD CLYDE CONSULTANTS		DATE EXTRACTED	: 01/05/90
PROJECT # : 8953237N-SA02		DATE ANALYZED	: 01/20/90
PROJECT NAME : BROADWAY & PALOMAR		SAMPLE MATRIX	: SOIL
:EF I.D. : 00105309		UNITS	: MG/KG

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
'IAZINON	<0.033	0.40	0.39	98	0.39	98	0
METHYL PARATHION	<0.033	0.33	0.45	136	0.41	124	9
GUTHION	<0.17	0.67	0.64	9.6	0.64	9.6	0
:THYL PARATHION	<0.033	0.37	0.48	130*	0.44	119	9

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

* Result out of limits due to sample matrix interference

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : EPA 8140 (ORGANOPHOSPHORUS PESTICIDES)

CLIENT	: WOODWARD CLYDE CONSULTANTS	ATI I.D.	: 001053
PROJECT #	: 8953237N-SA02	DATE EXTRACTED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE ANALYZED	: 01/19/90
CLIENT I.D.	: REAGENT BLANK	UNITS	: MG/KG
		DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
O-DEMETON	<0.033
S-DEMETON	<0.033
DIAZINON	<0.033
DISULFOTON	<0.033
METHYLPARATHION	<0.033
MALATHION	<0.066
ETHYL PARATHION	<0.033
ETHION	<0.033
AZINPHOSMETHYL (GUTHION)	<0.17

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105311

TEST : EPA 8140 (ORGANOPHOSPHORUS PESTICIDES)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: S-3P	DATE ANALYZED	: 01/20/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
O-DEMETON	<0.033
S-DEMETON	<0.033
DIAZINON	<0.033
DISULFOTON	<0.033
METHYLPARATHION	<0.033
MALATHION	<0.066
ETHYL PARATHION	<0.033
ETHION	<0.033
AZINPHOSMETHYL (GUTHION)	<0.17

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105310

TEST : EPA 8140 (ORGANOPHOSPHORUS PESTICIDES)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: S-2P	DATE ANALYZED	: 01/20/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
O-DEMETON	<0.033
S-DEMETON	<0.033
DIAZINON	<0.033
DISULFOTON	<0.033
METHYLPARATHION	<0.033
MALATHION	<0.066
ETHYL PARATHION	<0.033
ETHION	<0.033
AZINPHOSMETHYL (GUTHION)	<0.17

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105309

TEST : EPA 8140 (ORGANOPHOSPHORUS PESTICIDES)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: S-1P	DATE ANALYZED	: 01/20/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
O-DEMETON	<0.033
S-DEMETON	<0.033
DIAZINON	<0.033
DISULFOTON	<0.033
METHYLPARATHION	<0.033
MALATHION	<0.066
ETHYL PARATHION	<0.033
ETHION	<0.033
AZINPHOSMETHYL (GUTHION)	<0.17

AnalyticalTechnologies,Inc.

QUALITY CONTROL DATA

TEST : EPA 8080 (ORGANOCHLORINE PESTICIDES AND PCB'S)

ATI. I.D. : 001053

CLIENT : WOODWARD CLYDE CONSULTANTS
PROJECT # : 8953237N-SA02
PROJECT NAME : BROADWAY & PALOMAR
REF I.D. : REAGENT SOIL

DATE EXTRACTED : 01/05/90
DATE ANALYZED : 01/14/90
SAMPLE MATRIX : SOIL
UNITS : MG/KG

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
GAMMA BHC	<0.0050	0.027	0.023	85	N/A	N/A	N/A
HEPTACHLOR	<0.0050	0.027	0.017	63	N/A	N/A	N/A
ALDRIN	<0.0050	0.027	0.015	56	N/A	N/A	N/A
DIELDRIN	<0.010	0.067	0.075	112	N/A	N/A	N/A
ENDRIN	<0.010	0.067	0.052	78	N/A	N/A	N/A
P,P'-DDT	<0.010	0.067	0.080	119	N/A	N/A	N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Analytical Technologies, Inc. GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : EPA 8080 (ORGANOCHLORINE PESTICIDES AND PCB'S)

CLIENT	: WOODWARD CLYDE CONSULTANTS	ATI I.D.	: 001053
PROJECT #	: 8953237N-SA02	DATE EXTRACTED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE ANALYZED	: 01/13/90
CLIENT I.D.	: REAGENT BLANK	UNITS	: MG/KG
		DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
ALDRIN	<0.005
ALPHA - BHC	<0.005
BETA - BHC	<0.005
GAMMA-BHC (LINDANE)	<0.005
DELTA - BHC	<0.005
CHLORDANE	<0.050
P,P'-DDD	<0.010
P,P'-DDE	<0.010
P,P'-DDT	<0.010
O,P'-DDD	<0.010
O,P'-DDE	<0.010
O,P'-DDT	<0.010
DIELDRIN	<0.010
ENDOSULFAN I	<0.005
ENDOSULFAN II	<0.010
ENDOSULFAN SULFATE	<0.010
ENDRIN	<0.010
ENDRIN KETONE	<0.010
HEPTACHLOR	<0.005
HEPTACHLOR EPOXIDE	<0.005
METHOXYCHLOR	<0.050
TOXAPHENE	<0.10
AROCLOR 1016	<0.050
AROCLOR 1221	<0.050
AROCLOR 1232	<0.050
AROCLOR 1242	<0.050
AROCLOR 1248	<0.050
AROCLOR 1254	<0.050
AROCLOR 1260	<0.050

SURROGATE PERCENT RECOVERIES

DBC (%)	122

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105311

TEST : EPA 8080 (ORGANOCHLORINE PESTICIDES AND PCB'S)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: S-3P	DATE ANALYZED	: 01/14/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 20

COMPOUNDS	RESULTS
ALDRIN	<0.10
ALPHA - BHC	<0.10
BETA - BHC	<0.10
GAMMA-BHC (LINDANE)	<0.10
DELTA - BHC	<0.10
CHLORDANE	<1.0
P,P'-DDD	<0.20
P,P'-DDE	1.1
P,P'-DDT	2.3
O,P'-DDD	<0.20
O,P'-DDE	<0.20
O,P'-DDT	0.20
DIELDRIN	<0.20
ENDOSULFAN I	<0.10
ENDOSULFAN II	<0.20
ENDOSULFAN SULFATE	<0.20
ENDRIN	<0.20
ENDRIN KETONE	<0.20
HEPTACHLOR	<0.10
HEPTACHLOR EPOXIDE	<0.10
METHOXYCHLOR	<1.0
TOXAPHENE	3.3
AROCLOR 1016	<1.0
AROCLOR 1221	<1.0
AROCLOR 1232	<1.0
AROCLOR 1242	<1.0
AROCLOR 1248	<1.0
AROCLOR 1254	<1.0
AROCLOR 1260	<1.0

SURROGATE PERCENT RECOVERIES

DBC (%)	**

** Due to the necessary dilution of the sample, result was not attainable

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105310

TEST : EPA 8080 (ORGANOCHLORINE PESTICIDES AND PCB'S)

LIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
ROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
LIENT I.D.	: S-2P	DATE ANALYZED	: 01/14/90
AMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 20

OMPOUNDS	RESULTS
LDRIN	<0.10
LPHA - BHC	<0.10
BETA - BHC	<0.10
AMMA-BHC (LINDANE)	<0.10
ELTA - BHC	<0.10
HLORDANE	<1.0
P,P'-DDD	<0.20
,P'-DDE	0.52
,P'-DDT	1.4
O,P'-DDD	<0.20
.P'-DDE	<0.20
'-DDT	<0.20
DIELDRIN	<0.20
NDOSULFAN I	<0.10
NDOSULFAN II	<0.20
NDOSULFAN SULFATE	<0.20
ENDRIN	<0.20
NDRIN KETONE	<0.20
EPTACHLOR	<0.10
HEPTACHLOR EPOXIDE	<0.10
ETHOXYCHLOR	<1.0
OXAPHENE	<2.0
AROCLOR 1016	<1.0
ROCLOR 1221	<1.0
ROCLOR 1232	<1.0
AROCLOR 1242	<1.0
AROCLOR 1248	<1.0
ROCLOR 1254	<1.0
ROCLOR 1260	<1.0

SURROGATE PERCENT RECOVERIES

DBC (%)	**

** Due to the necessary dilution of the sample, result was not attainable

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 00105309

TEST : EPA 8080 (ORGANOCHLORINE PESTICIDES AND PCB'S)

CLIENT	: WOODWARD CLYDE CONSULTANTS	DATE SAMPLED	: 01/04/90
PROJECT #	: 8953237N-SA02	DATE RECEIVED	: 01/05/90
PROJECT NAME	: BROADWAY & PALOMAR	DATE EXTRACTED	: 01/05/90
CLIENT I.D.	: S-1P	DATE ANALYZED	: 01/14/90
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 10

COMPOUNDS	RESULTS
ALDRIN	<0.050
ALPHA - BHC	<0.050
BETA - BHC	<0.050
GAMMA-BHC (LINDANE)	<0.050
DELTA - BHC	<0.050
CHLORDANE	<0.50
P,P'-DDD	<0.10
P,P'-DDE	0.37
P,P'-DDT	0.50
O,P'-DDD	<0.10
O,P'-DDE	<0.10
O,P'-DDT	<0.10
DIELDRIN	<0.10
ENDOSULFAN I	<0.050
ENDOSULFAN II	<0.10
ENDOSULFAN SULFATE	<0.10
ENDRIN	<0.10
ENDRIN KETONE	<0.10
HEPTACHLOR	<0.050
HEPTACHLOR EPOXIDE	<0.050
METHOXYCHLOR	<0.50
TOXAPHENE	1.6
AROCLOR 1016	<0.50
AROCLOR 1221	<0.50
AROCLOR 1232	<0.50
AROCLOR 1242	<0.50
AROCLOR 1248	<0.50
AROCLOR 1254	<0.50
AROCLOR 1260	<0.50

SURROGATE PERCENT RECOVERIES

DBC (%)	84

Analytical Technologies, Inc. GENERAL CHEMISTRY - QUALITY CONTROL

CLIENT : WOODWARD CLYDE CONSULTANTS
PROJECT # : 8953237N-SA02
PROJECT NAME : BROADWAY & PALOMAR

ATI I.D. : 001053

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP. RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
PETROLEUM HYDROCARBONS	MG/KG	00108504	3	4	29	140	130	105

% Recovery = $\frac{\text{(Spike Sample Result - Sample Result)}}{\text{Spike Concentration}}$ X 100

RPD (Relative Percent Difference) = $\frac{\text{(Sample Result - Duplicate Result)}}{\text{Average Result}}$ X 100

DUDEK & ASSOCIATES, INC.

605 Third Street
Encinitas, CA 92024
(619) 942-5147 • Fax No. (619) 632-0164

363-01

July 19, 1991

Mr. Michael Mezey
Environmental Planner
Cotton/Beland/Associates, Inc.
619 South Vulcan Avenue, Suite 205
Encinitas, CA 92024

Re: Palomar Trolley Center Hydrology Study

Dear Mike:

We are pleased to present you with the results of our hydrology study for the Palomar Trolley Center. Our study investigated the hydrology of the local watershed and analyzed the hydraulics of the culverts at the MTDB tracks.

HYDROLOGIC ANALYSIS

Existing hydrologic information pertaining to the Palomar Trolley Center site was examined. This data included maps, reports and plans. The City of Chula Vista Master Drainage Plan has been completed, but is undergoing internal review, and is unavailable to the public until adopted by the City Council. Since this new study could not be used, we used information from Chula Vista's original Drainage Master Plan, which was prepared for the City by Lawrence, Fogg, Florer & Smith (LFFS) in 1964. This study indicated a 50 year flow of 231 cfs at concentration point 2 (see Appendix C).

Our hydrology map for this study is shown in Figure 1. The watershed was divided into catchment areas with the area labeled "A" as the project site. At concentration point 1, runoff was calculated for the existing conditions for both the 10 year and 50 year frequency flows. The Palomar Trolley Center site area is downstream of this concentration point, and does not impact the runoff volumes at future build-out conditions. At point 2, runoff was calculated for both the existing conditions (no project), and with the proposed Trolley Center for both frequency flows. The results of this portion of our study are tabulated in Table 1 (hydrologic calculations may be found in Appendix A). Table 1 shows the 50 year frequency runoff at point 2 for the existing condition is 318 cfs. The runoff for the future condition is 333 cfs; therefore, the impact of the development is an increase of approximately 15 cfs at this point.

The watershed characteristics have changed significantly from the time the LFFS study was published. A comparison of Figure 1 and Appendix C shows the area has changed from an undeveloped/agricultural use to a residential/commercial land use area. Increased areas of development increases the amount of impervious area in the watershed which results in larger storm runoff volumes. A comparison between the runoff volume in the LFFS study and the present hydrologic conditions in Table 1 reflects this change.

Our study included a brief site visit to verify portions of the drainage watershed boundaries, general hydrologic conditions, and culvert locations and sizes. We employed the modified rational method to study this 230 acre watershed. The modified rational method is generally accepted for calculating stormwater runoff for watershed areas up to 320 acres.

Table 1

Summary of Runoff Volumes at Concentration Point 2
(Modified Rational Method)

	LFFS Study (cfs)	Existing (cfs)	Future (cfs)
Q_{50}	231	318	333
Q_{10}		255	267

HYDRAULIC CALCULATIONS

We analyzed the capacity of the culverts that pass beneath the MTDB Trolley Tracks downstream of the project. We assumed, for the purposes of this study, that the downstream ends of these culverts were not submerged. The capacity of these culverts, based on slopes taken from the existing LFFS report and on information gathered during our site visit, is shown in Table 2. The elevation of the trolley tracks was estimated from the 1974 200-foot scale San Diego County ortho-topographic map to be approximately 52 feet. The sump elevation was estimated to be approximately 39 feet; allowing for at least 10 feet of head at these culverts if 3 feet of freeboard is allowed. Due to the lack of recent topographic maps and field surveys showing as-built elevations, this analysis is subject to revision.

Mr. Michael Mezey
Cotton/Beland/Associates, Inc.

Table 2 shows the flow through the culverts under the MTDB Trolley Tracks. The maximum flow through the culverts will occur at maximum headwater depth. If the sump elevation is estimated to be at 39 feet and the trolley tracks elevation at 52 feet, then the maximum headwater elevation would be approximately 13 feet. The flow through the culverts at this headwater elevation is approximately 450 cfs.

The hydraulic calculations may be found in Appendix B. The analyses of the 36" RCP assumed inlet control at headwater depths below approximately 7 feet, and outlet control at higher headwater depths. For the analyzed flows through the 66" CMP, outlet control was assumed. Outlet control means the headwater elevation required to discharge the design flow is determined by culvert headlosses. Inlet control means the entrance conditions do not allow the water to enter the culvert quickly enough to fill the culvert.

Table 2

Pipe Culvert Analysis

Headwater Depth (ft)	Approx. Water Surface Elevation	Flow Rate (cfs)		Combined Flow (cfs)
		36" RCP	66" CMP	
6	45	80	170	250
7	46	88	200	288
8	47	95	225	320
9	48	103	250	353
10	49	107	270	377
13	52	123	330	453

The results of the hydrologic and hydraulic calculations indicate that the culverts running beneath the MTDB Trolley Tracks have sufficient capacity to handle the expected flows if some surcharge is allowed. To estimate the extent of flooding a given flow rate will cause at this point, updated topographic maps of the area would be required, since recent development of the industrial park and the trolley parking have been made after the 1974 ortho-topographic maps. If the headwater depth is 10 feet, the water surface elevation at the culvert inlet would be 49 feet. The areal extent in which flooding occurs at elevations below 49 feet cannot be estimated without more information. Similarly, the impact of tailwater flooding on the upstream culverts cannot be predicted without more information.

From the site visit, the unimproved drainage ditch south of the project site was overgrown with weeds and had undefined boundaries. Hydraulic parameters cannot be estimated for this ditch because of its irregular side slopes, undefined channel bottom width, and poor hydraulic condition. Preliminary site development plans did not show any type of drainage improvements, but it is expected that some type of channel improvement will eventually be required with this project.

CITY OF CHULA VISTA THRESHOLD STANDARDS

The City's Threshold Standards for Drainage are:

"1. Storm water flows and volumes shall not exceed City Engineering Standards.

2. The GMOC [Growth Management Oversight Committee] shall annually review the performance of the City's storm drain system to determine its ability to meet the goals and objectives above."

The goal is "to provide a safe and efficient storm water drainage system to protect residents and property in the City of Chula Vista." Development projects in the City of Chula Vista are required to meet the City's Threshold Standards so that improvements are consistent with the Master Drainage Plan and engineering standards.

The City of Chula Vista Subdivision Manual states that special design for sump conditions to protect property will be required, but does not specify any design criteria.

IMPACTS AND POTENTIAL MITIGATION MEASURES

From the site visit, the watershed area appears to be fully developed from a hydrologic stand point, except for Area A which will be developed as the project site. Since we have already included the impact of development on this site, only minimal additional flows may be expected from future development.

Potential mitigation measures for downstream impacts caused by increased flows resulting from the construction of the Palomar Trolley Center are listed below. These measures will reduce the volume of stormwater runoff and/or decrease the peak flows.

- **Detention and Retention Basins**

  Detention and retention basins provide for storage of increased stormwater runoff. Detention basins are designed to release the surface water at specific rates at or below the naturally occurring runoff rate. Retention basins release retained water via in-situ infiltration. Both basins attenuate peak flows.

- **Porous Pavements**

  Porous pavements are composed of large, coarse aggregate with high void ratios which increases permeability rates. Porous pavements seek to reduce the volume of stormwater runoff by increasing infiltration, thereby also reducing peak flows.

- **Infiltration Trench**

  Infiltration trenches are shallow, excavated trenches, generally 2 feet to 10 feet in depth and filled with coarse aggregate. These trenches allow for the storage of stormwater runoff which gradually infiltrates into the surrounding soil.

- **Upgraded Hydraulic Structures**

  - Linings. The culvert pipes can be lined to reduce the frictional resistance, thereby increasing capacity.

  - Improved Entrance Conditions. The culvert entrance conditions may be improved to decrease turbulent conditions, thereby increasing flow capacity. Improvements may include beveled, rounded and flushed inlets.

The effectiveness of all these mitigation measures are enhanced with proper construction and maintenance programs.

CONCLUSIONS

The 36" RCP and 66" CMP culverts passing beneath the MTDB Trolley Tracks appear to be adequate to accept the 50 year frequency storm event when construction is completed at the project site. The 50 year storm runoff volume is expected to be approximately 335 cfs. The combined flow of the culverts will accommodate this flow with a headwater of less than 9 feet and assuming a tailwater depth of about 3 feet. With more recent information on as-built conditions and topography, the extent of potential flooding may be predicted.

The impact of the development of this 18.2 acre project site, out of the 230 acre watershed, is essentially negligible since it represents only about 6% of the watershed area. Further urbanization and land use changes in this watershed may increase the watersheds imperviousness, but watershed urbanization is almost near complete build-out. The Palomar Trolley Center represents the final major parcel of agricultural land to be developed in this watershed.

We are pleased to have offered our engineering services to you and hope to work with you in future endeavors. If you have any questions, or if we can be of further assistance, please do not hesitate to call me at (619) 942-5147.

Very truly yours,

Dudek & Associates, Inc.

Gail K Masutani

Gail K. Masutani, Ph.D., P.E.
Project Engineer

cc: Chuck Spinks, Dudek & Associates, Inc.
Jim Rasmus, Dudek & Associates, Inc.

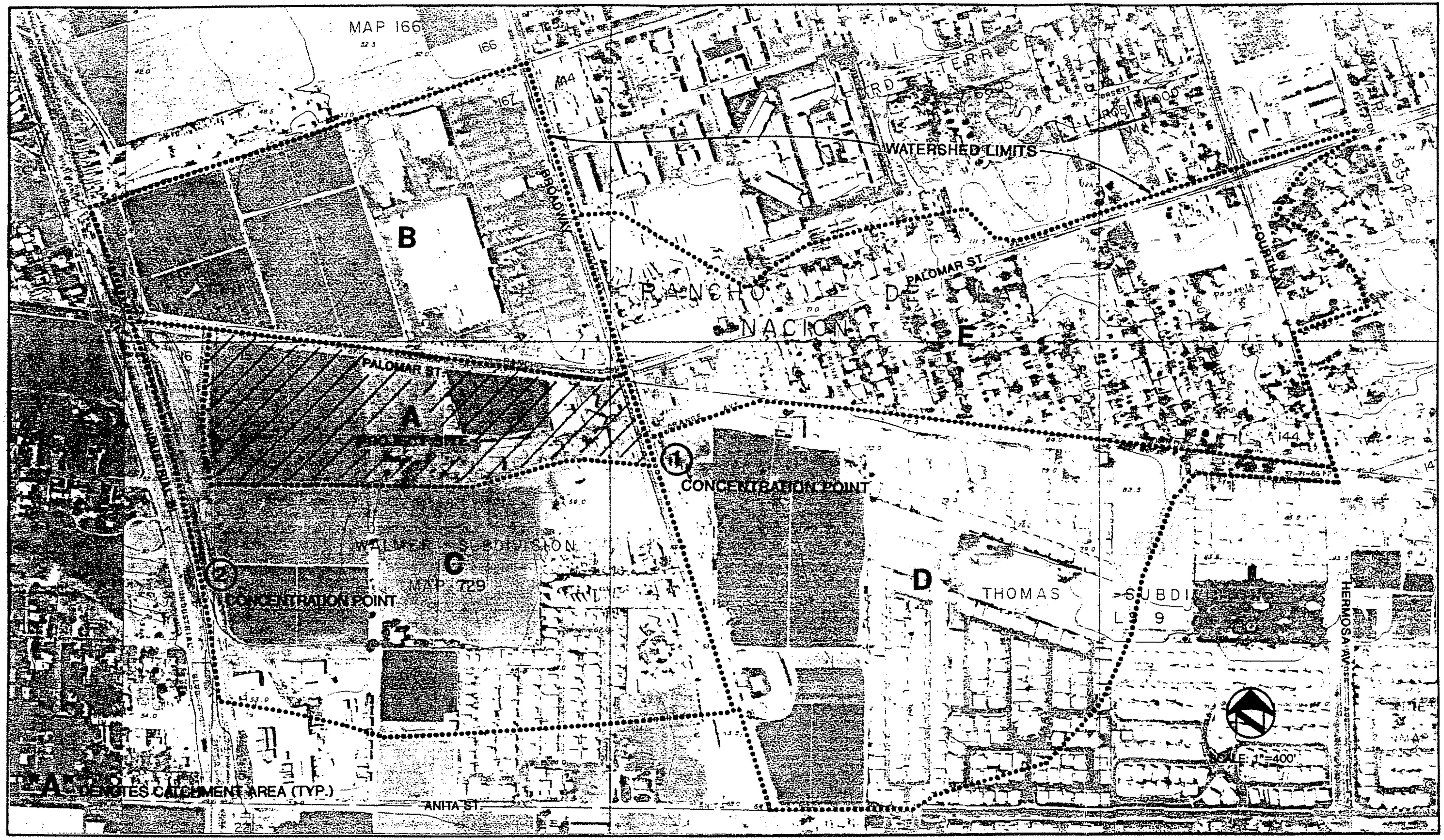


FIGURE 1

PALOMAR TROLLEY CENTER DRAINAGE WATERSHED

DUDEK & ASSOCIATES, INC.

APPENDIX A

AREAS

FROM CAD DIGITIZER

AREA

A
904085.53 ft^2 = 20.75
909759.27 ft^2 = 20.89 $\bar{x}$ = 20.8 acres
904355.97 ft^2 = 20.76

B
1742895.95 ft^2 = 40.00
1742503.01 ft^2 = 40.00 $\bar{x}$ = 40.0 acres
1743019.79 ft^2 = 40.01

C
2167229.29 ft^2 = 49.75
217[illegible] ft^2 = 49.96 $\bar{x}$ = 49.9 acres
2179235.70 ft^2 = 50.03

D
2754[illegible] ft^2 = 63.24
2751036.53 ft^2 = 63.15 $\bar{x}$ = 63.2 acres

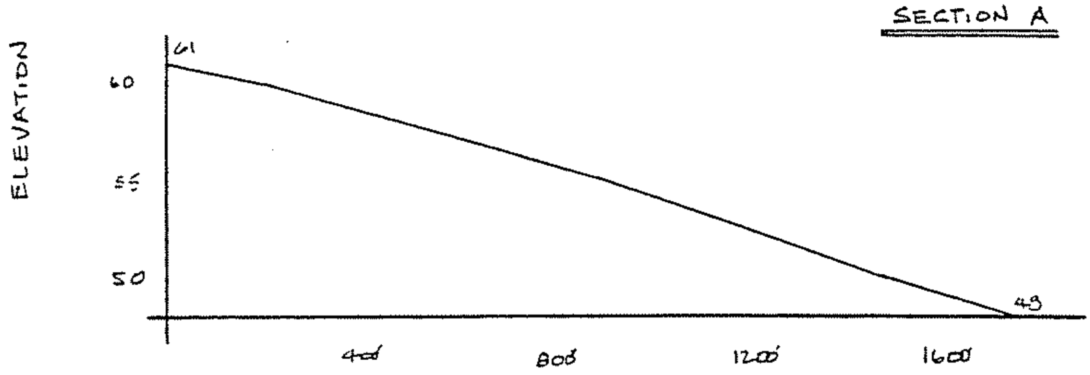
E
24[illegible].73 ft^2 = 56.3[illegible]
2451677.13 ft^2 = 56.29 $\bar{x}$ = 56.3 acres
24~~434~~[illegible].34 ft^2 = 56.09

DUDEK & ASSOCIATES, INC.

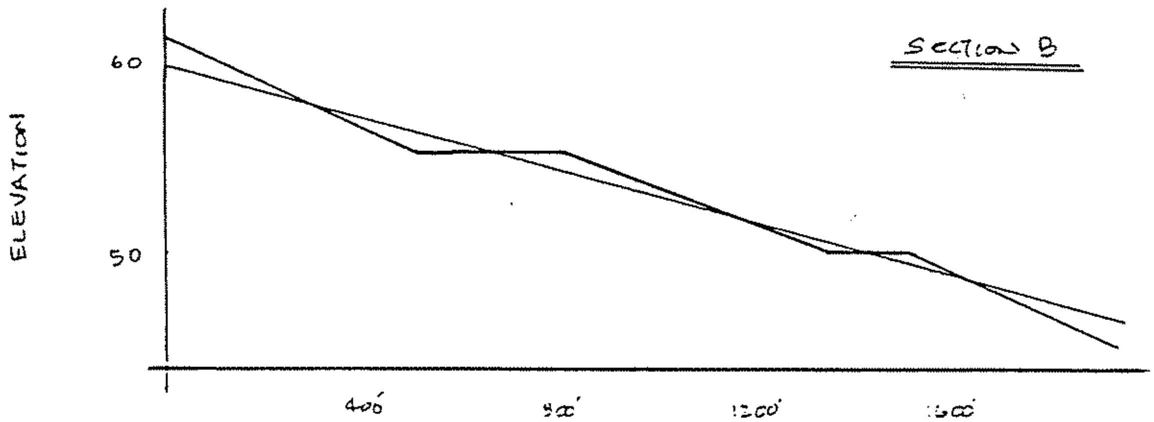
PROJECT: PALOMAR TROLLEY CENTER (AREAS) JOB NO. 363-01

BY [illegible] DATE [illegible] CHKD BY DATE SHEET 1 OF [illegible]

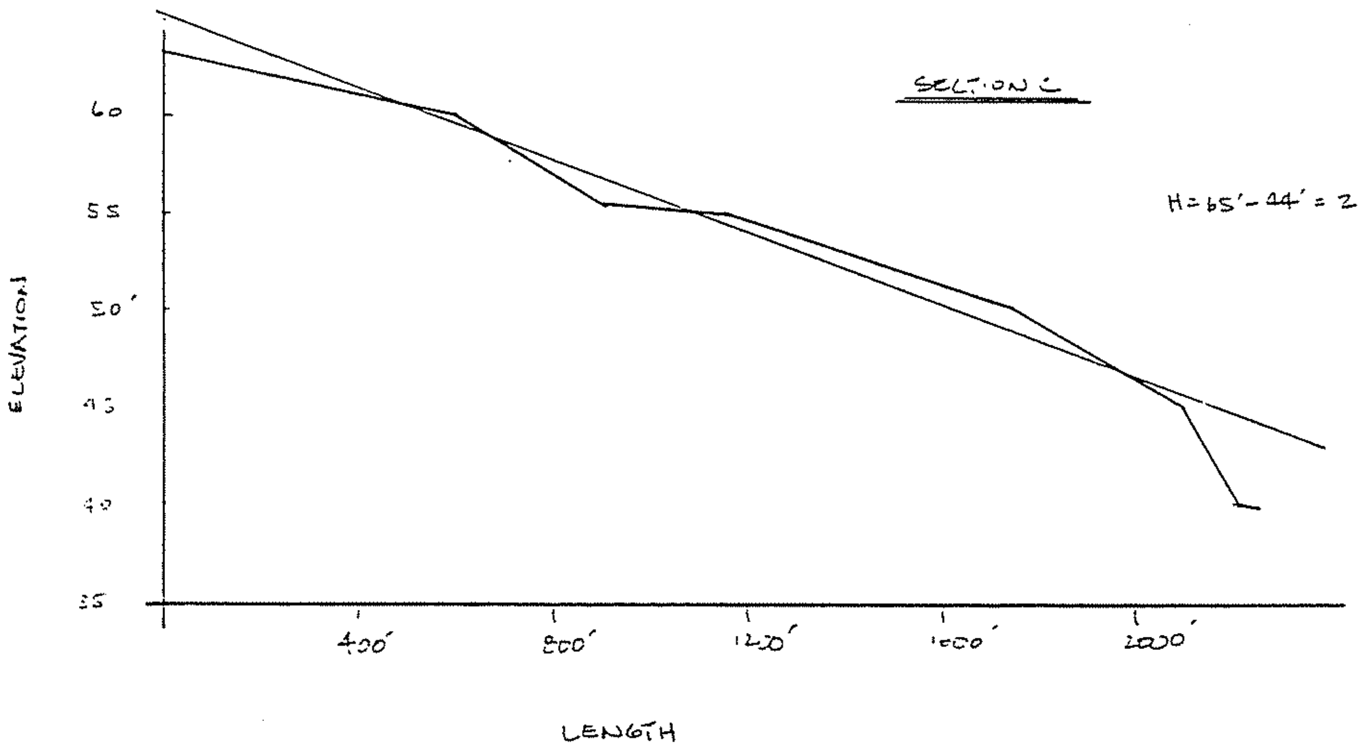
L PROFILES



H = 61 − 49 = 12′



H = 59.5 − 47.5 = 12′



H = 65′ − 44′ = 21′

AREA NAME	AREA (acres)	LENGTH (ft)	HEIGHT[1] (ft)	t_c[2] (min.) (for area only)	Rainfall Intensity[3] I_{50}	I_{10}
A	20.8	1740′	13	16.1	2.45	2.05
B	40.0	1950′	12	18.9	2.25	1.85
C	49.9	2250′	21	18.0	2.30	1.90
D	63.2	2820′	30	20.4	2.20	1.75
E	56.3	3330′	43	21.5	2.10	1.70
	Σ 230.2					

1 from profiles

2 $t_c = 60\left(\frac{11.9L^3}{H}\right)^{0.385}$ L = miles, H = ft., t_c = min

IF $t_c > 15$ min. NO ADDITIONS TO t_c. (City of Chula Vista Subdivision Manual, p.71)

3 RAINFALL INTENSITY vs t_c FROM CVDS 17.

"C" VALUES (from City of Chula Vista Subdivision Manual p.70)

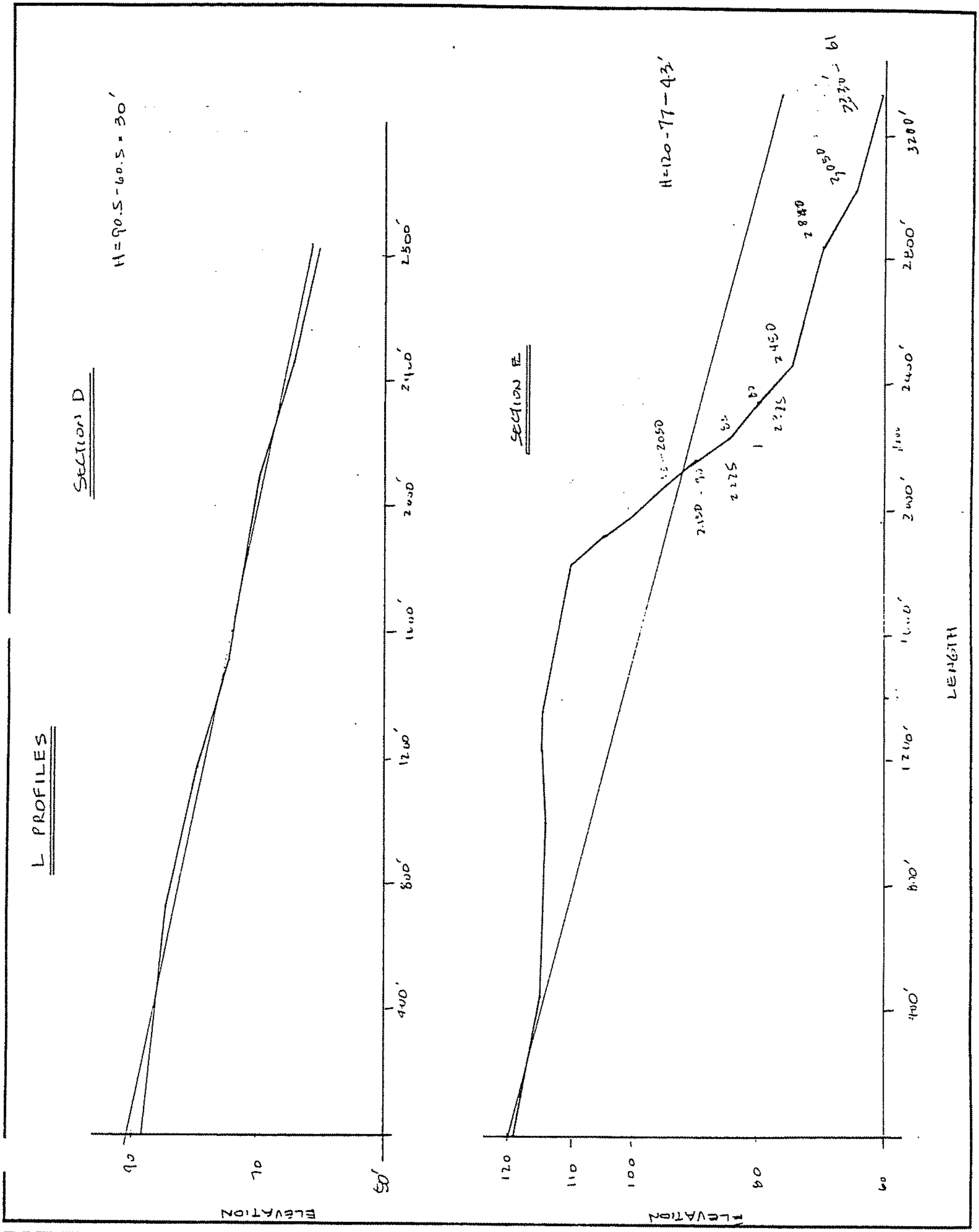
AREA A: Before development: C = 0.45
after development C = 0.85

B: C = 0.35

C: C = 0.35

D: C = 0.75 (Dense residential)

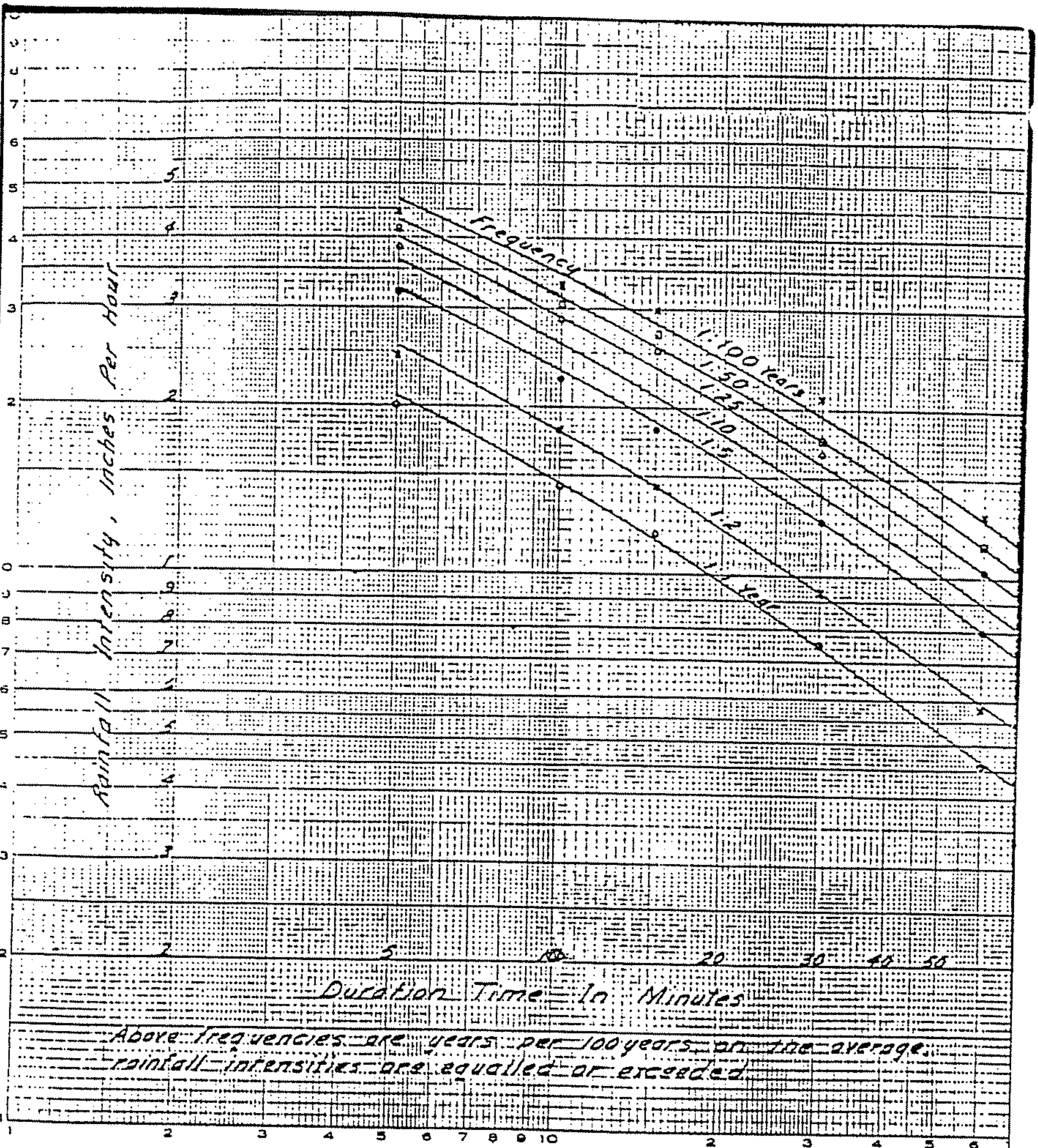
E: C = 0.65 (Normal residential)



DUDEK &
ASSOCIATES, INC.

PROJECT: CBA PALOMAR TROLLEY CENTER JOB NO. 362-01

10 x 10



ABOVE FREQUENCIES ARE YEARS PER 100 YEARS, ON THE AVERAGE, RAINFALL INTENSITIES ARE EQUALLED OR EXCEEDED.

Revised	Drawn R. J. C.	Date 9-18-67	CITY OF CHULA VISTA PUBLIC WORKS DEPARTMENT	
3/5/75 T.L.	Approved	Date 11-16-67		
8/25/...			RAINFALL INTENSITY DURATION CURVE	CVDS 17
	Director of Public Works			

RUNOFF VOLUMES $Q = ciA$

	EXISTING INDIVIDUAL AREAS,		FUTURE	
AREA	Q_{50}	Q_{10}	Q_{50}	Q_{10}
A	22.9 cfs	19.2 cfs	43.3 cfs	36.2 cfs
B	76.5 cfs	62.9 cfs		
C	78.2 cfs	64.6 cfs		
D	104.3 cfs	83.0 cfs		
E	76.8 cfs	62.2 cfs		
TOTAL	359 cfs	292 cfs.	379 cfs.	309 cfs

MODIFIED RATIONAL METHOD $Q = i(\Sigma CA)$ for i which has longest t_c.

AREAS D & E MERGE AT POINT ①. $Q'_{50} = 2.1[(0.75)(63.2) + (0.65)(56.3)] = 176.4$ cfs

$Q'_{10} = 1.7[(0.75)(63.2) + (0.65)(56.3)] = 142.8$ cfs.

AREAS (D+E) and A, B, C MERGE AT POINT ②

a) FROM POINT ① TO POINT ②, t_c OF FLOWS D+E

LENGTH FROM ① TO ② IS 1930'.

Say 42" CMP $n = 0.018$ (p. 72)

$V = \frac{1.49}{n} R^{2/3} S^{1/2}$ $S = \frac{61-38}{1930} = 0.012$ But minimum grade = 0.005

So use 0.005

Say storm sewer is 3/4 full $\frac{R}{D} = 0.3017 \Rightarrow R = (0.3017)(3.5) = 1.056$

$V = \frac{1.49}{0.018}(1.056)^{2/3}(0.005)^{1/2} = 6.1$ ft/s.

$\therefore t_c = \frac{L}{V} = \frac{1950}{6.1} = 319.7$ sec $= 5.3$ min

$\therefore t = 5.3 + 21.5 = 26.8 \Rightarrow I_{50} = 1.87$ in/hr; $I_{10} = 1.5$ in/hr

EXISTING

$$Q^2_{50} = 1.87[\underbrace{(0.45)(20.8) + (0.85)(40.0) + (0.95)(49.9) + (0.75)(63.2) + (0.65)(56.3)}_{169.77}]$$

$= 317.5$ cfs

$$Q^2_{10} = 1.5[(0.45)(20.8) + (0.85)(40.0) + (0.85)(49.9) + (0.75)(63.2) + (0.65)(56.3)]$$

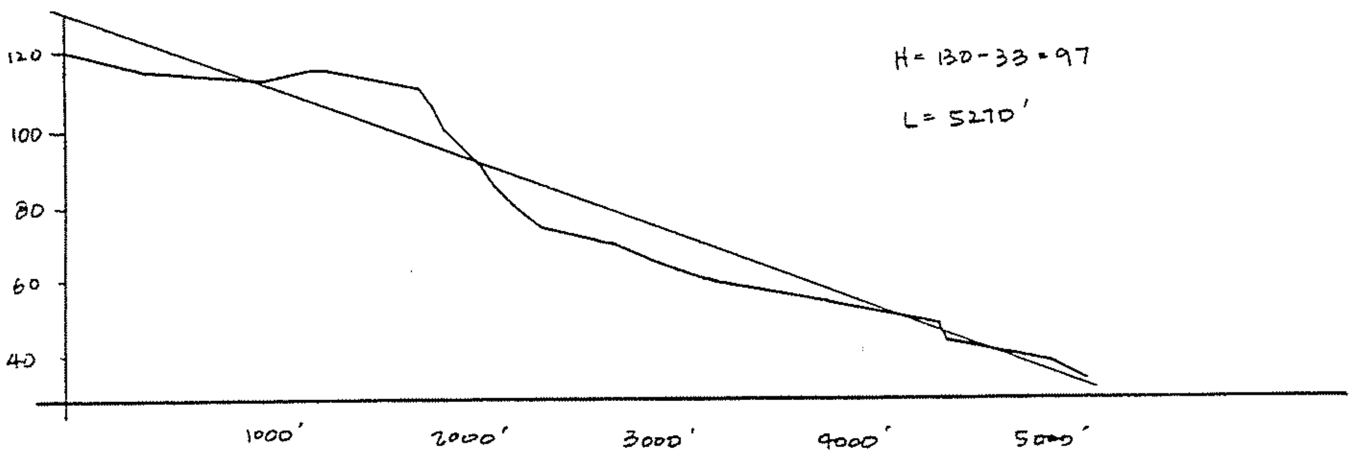
$= 254.7$ cfs.

b) WITH DEVELOPMENT : $Q^2_{50} = 333$ cfs $(= (1.87)(178.09))$

$Q^2_{10} = 267.1$ cfs. $(= (1.5)(178.09))$

SIMPLIFIED METHODS

① ASSUME ONE LARGE AREA



H = 130 - 33 = 97

L = 5270'

$t_c = 60\left(\frac{11.9\left(\frac{5270}{5280}\right)^3}{97}\right)^{0.385} = 26.7$ min $\quad I_{50} = 1.87$ in/hr; $I_{10} = 1.5$ in/hr

⟹ THESE RAINFALL INTENSITY VALUES ARE THE SAME AS CALCULATED FOR THE MODIFIED RATIONAL METHOD

SO Q^2_{50} AND Q^2_{10} VALUES ARE THE SAME

② ASSUME TWO LARGE AREAS (A, B, C AND DE).

a) ASSUME Q'S ADD

DE: $Q'_{50} = 176.4$ cfs. $Q'_{10} = 142.8$ cfs.

ABC: t_c LONGEST FOR SECTION B, BUT DOES NOT INCLUDE TRAVEL TIME TO POINT ⑤. FROM SITE VISIT, 54" CMP OUTLET.
ASSUME VALUES $n = 0.019$, $S = 0.005$ FROM MODIFIED RATIONAL HEIGHTS.

$R = (0.3017)(4.5) = 1.358$.

$V = \frac{1.49}{0.019}(1.358)^{2/3}(0.005)^{1/2} = 7.2$ ft/s.

L = 1100' (from SW CORNER OF B TO POINT ⑤).

$t = \frac{L}{V} = \frac{1100}{7.2} = 153$ sec $= 2.5$ min

$t_c = 2.5 + 18.9 = 21.4$ min $\Rightarrow I_{50} = 2.10$ in/hr, $I_{10} = 1.7$ in/hr

$Q^2_{50_{ABC}} = 2.1\left[(0.45)(20.3) + (0.35)(40.0) + (0.35)(49.9)\right] = 180.1$

$Q^2_{50} = Q^2_{50_{ABC}} + Q^2_{50_{DE}} = 180.1 + 176.4 = 357$ cfs.

$Q^2_{10_{ABC}} = 1.7[(0.45)(20.3) + (0.35)(40.0) + (0.85)(49.9)] = 145.8$ cfs.

$Q^2_{10} = Q^2_{10_{ABC}} + Q^2_{10_{DE}} = 145.8 + 142.8 = 289$ cfs.

So $Q^2_{50} = 357$ cfs + $Q^2_{10} = 289$ cfs. EXISTING

<u>WITH DEVELOPMENT</u> $Q^2_{50_{ABC}} = 2.1[(0.95)(20.3) + (0.35)(40.0) + (0.95)(49.9)] = 197.6$ cfs

$Q^2_{10_{ABC}} = 1.7[(0.95)(20.3) + (0.95)(40.0) + (0.95)(49.9)] = 160$ cfs.

So $Q^2_{50} = 197.6 + 176.4 = 374$ cfs

$Q^2_{10} = 160 + 142.8 = 313$ cfs.

b) ASSUME t_cS ADD.

DE $t_c = 21.5$

ABC $t_c = 21.4$ (SECTION B CONTROLS)

$\therefore t_c = 21.5 + 21.4 = 42.9$ $I_{50} = 1.40$ in/hr $I_{10} = 1.13$

AVERAGE C_E: $\dfrac{(0.45)(20.3) + (0.35)(40.0) + (0.85)(49.9) + (0.75)(63.2) + (0.65)(56.3)}{(230.2)} = 0.74$

EXISTING $Q_{50} = C_E I_{50} A_T = (0.74)(1.4)(230.2) = 238$ cfs

$Q_{10} = C_E I_{10} A_T = (0.74)(1.13)(230.2) = 192$ cfs.

AVERAGE $C_F = \dfrac{(0.35)(20.3) + (0.85)(40.0) + (0.95)(49.9) + (0.75)(63.2) + (0.65)(56.3)}{(230.2)} = 0.77$

FUTURE $Q_{50} = C_F I_{50} A_T = (0.77)(1.4)(230.2) = 248$ cfs.
$Q_{10} = C_F I_{10} A_T = (0.77)(1.13)(230.2) = 200$ cfs

SUMMARRY OF RUNOFF VOLUMES

ASSUMPTIONS ON $Q=CIA$	EXISTING		FUTURE	
	Q_{50}	Q_{10}	Q_{50}	Q_{10}
STRAIGHT CIA ADDITION	359 cfs	292 cfs	379 cfs	3.9 cfs
TWO AREAS, ADD Q	357 cfs	289 cfs	374 cfs	313 cfs.
MODIFIED RATIONAL	318 cfs	255 cfs	333 cfs	267 cfs
ONE LARGE AREA	310 cfs	255 cfs	333 cfs	267 cfs
ASSUME t_c ADD	238 cfs	192 cfs	248 cfs	200 cfs.

APPENDIX B

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

July 18, 1991
Palomar Trolley Study
36" RCP
363-01

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)................................	3.00
FHWA Chart Number (1,2 or 3)............................	3
Scale Number on Chart (Type of Culvert Entrance)........	1
Manning`s Roughness Coefficient (n-value)...............	0.0150
Entrance Loss Coefficient of Culvert Opening............	0.30
Culvert Length (feet)...................................	150.0
Culvert Slope (feet per foot)...........................	0.0171

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Veloci (fps)
60.0	1.50	4.38	3.25	2.02	2.50	2.02	11.87
75.0	1.50	5.60	5.08	2.53	2.72	2.53	11.79
80.0	1.50	6.06	5.76	2.65	2.77	2.65	12.09
85.0	1.50	6.56	6.49	3.00	2.81	3.00	12.03
90.0	1.50	7.08	7.25	3.00	2.85	2.85	12.98
95.0	1.50	7.64	8.05	3.00	2.87	2.87	13.64
100.0	1.50	8.22	8.89	3.00	2.90	2.90	14.30
105.0	1.50	8.84	9.77	3.00	2.91	2.91	14.98
110.0	1.50	9.48	10.69	3.00	2.93	2.93	15.66
115.0	1.50	10.16	11.65	3.00	2.94	2.94	16.35
120.0	1.50	10.87	12.65	3.00	2.95	2.95	17.04
125.0	1.50	11.60	13.70	3.00	2.96	2.96	17.74

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

July 18, 1991
Palomar Trolley Study
66" CMP
363-01

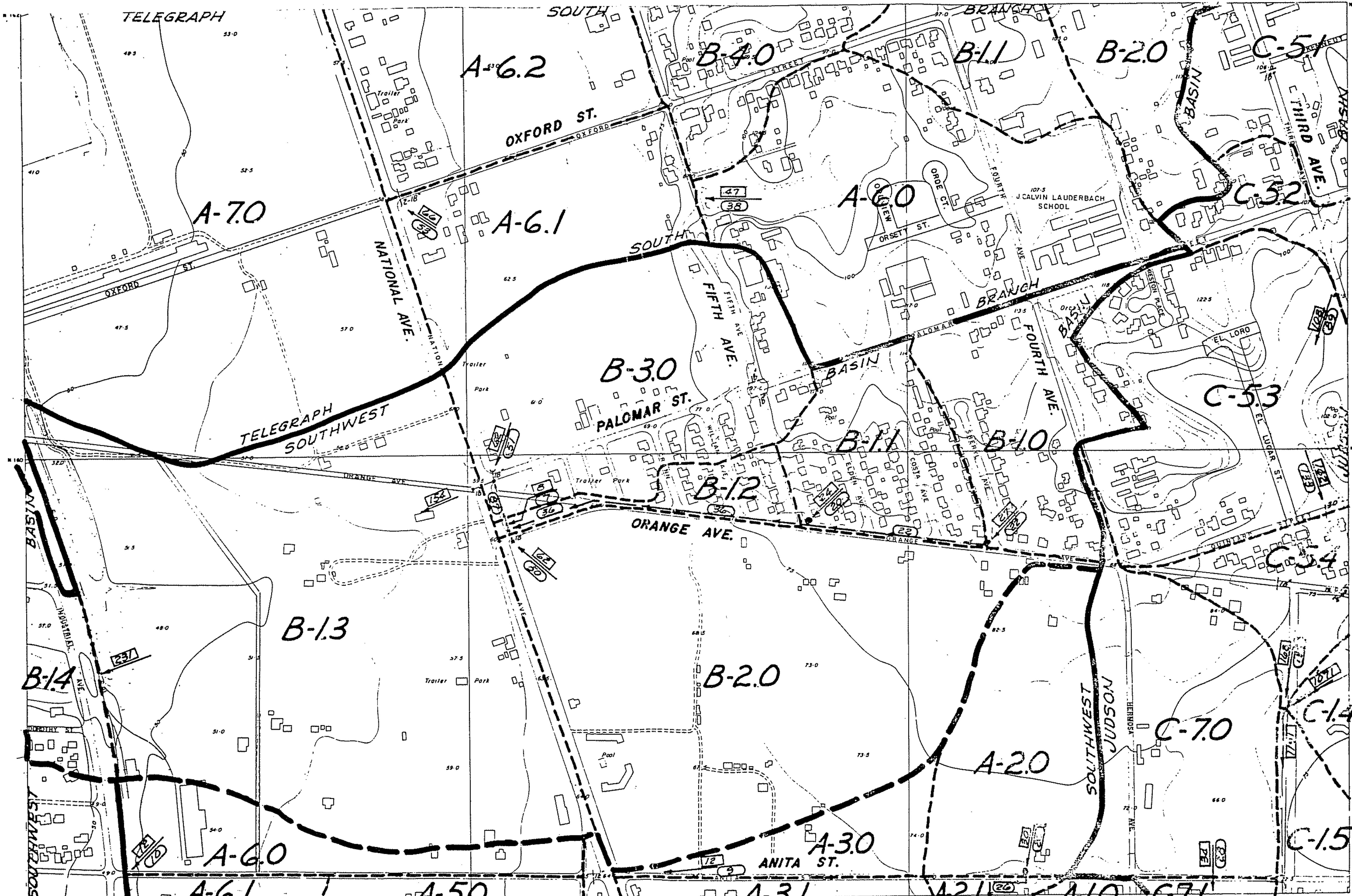
PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)....................................	5.50
FHWA Chart Number (1,2 or 3)...............................	2
Scale Number on Chart (Type of Culvert Entrance)........	1
Manning`s Roughness Coefficient (n-value)...............	0.0220
Entrance Loss Coefficient of Culvert Opening............	0.50
Culvert Length (feet)....................................	150.0
Culvert Slope (feet per foot)...........................	0.0055

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
160.0	2.75	5.42	5.72	5.50	3.53	3.53	9.92
170.0	2.75	5.65	6.03	5.50	3.64	3.64	10.17
180.0	2.75	5.89	6.37	5.50	3.75	3.75	10.42
200.0	2.75	6.48	7.07	5.50	3.96	3.96	10.92
220.0	2.75	7.09	7.83	5.50	4.15	4.15	11.44
230.0	2.75	7.35	8.23	5.50	4.24	4.24	11.70
250.0	2.75	7.99	9.08	5.50	4.41	4.41	12.24
260.0	2.75	8.33	9.52	5.50	4.49	4.49	12.52
270.0	2.75	8.69	9.98	5.50	4.56	4.56	12.81
300.0	2.75	9.84	11.43	5.50	4.77	4.77	13.72
320.0	2.75	10.67	12.47	5.50	4.88	4.88	14.36
330.0	2.75	11.11	13.01	5.50	4.93	4.93	14.69

APPENDIX C



LEGEND

- 326 ULTIMATE RUN-OFF 50 YR. FREQUENCY
- 432 PRESENT RUN-OFF 50 YR. FREQUENCY
- 230 ULTIMATE RUN-OFF 10 YR. FREQUENCY
- PROPOSED STORM DRAIN
- MAJOR DRAINAGE BASINS

SCALE 1:2400

200 0 200 400 600 800 1000 Feet

Contour Interval 5 Feet
U S C & G S Datum
ONE THOUSAND FOOT CALIFORNIA RECTANGULAR GRID (ZONE V)

LAWRENCE, FOGG, FLORER & SMITH
CIVIL ENGINEERS

INDEX TO ADJOINING SHEETS

26-82	27-82	28-82